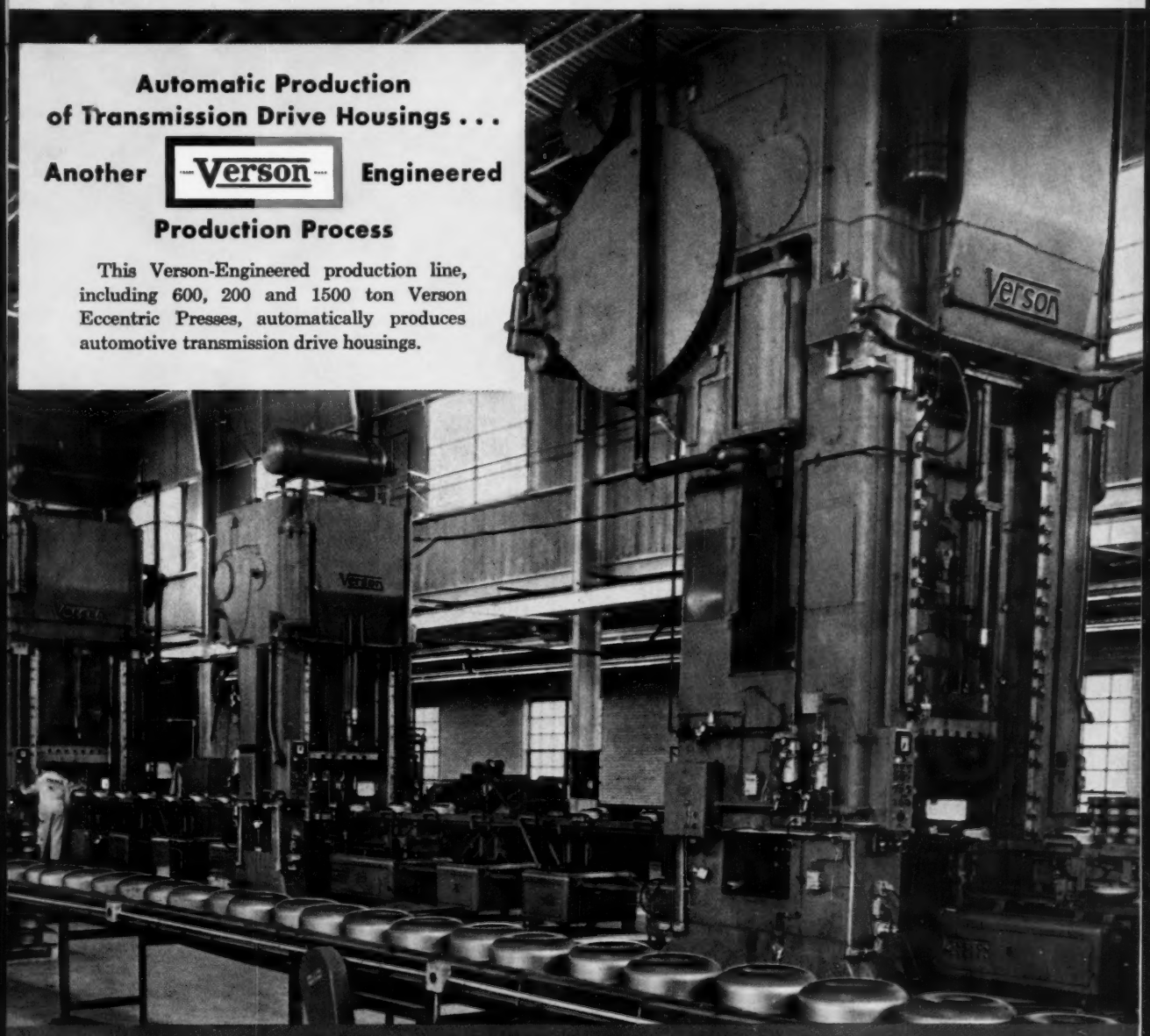
AUGUST 1956—SIXTY-SECOND YEAR

MACHINERY

Automatic Production of Transmission Drive Housings . . .

Another Verson Engineered Production Process

This Verson-Engineered production line, including 600, 200 and 1500 ton Verson Eccentric Presses, automatically produces automotive transmission drive housings.



Anyone can build a press.....

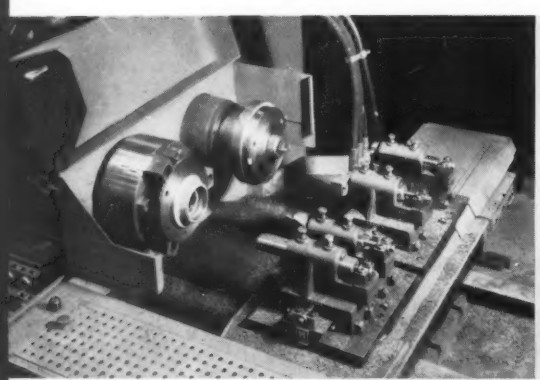
Verson builds production processes

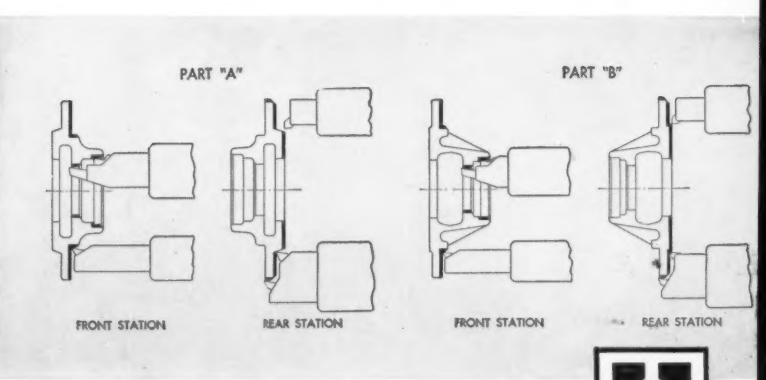
VERSON ALLSTEEL PRESS COMPANY • CHICAGO and DALLAS

The ability of Heald **BORIZING*** to

combine operations and reduce handling time can make other precision finishing methods obsolete, regardless of age of equipment

FOR EXAMPLE: *This One Bore-Matic Replaced Two Older Machines and Increased Production more than 50%*





This new Heald Model 321 Bore-Matic performs combined boring, turning and facing operations on both ends of two different differential bearing carriers, as shown in the diagrams above. The job was formerly done in sequential operations on two separate machines, at a net production of 105 parts per hour. Borizing on this single-machine setup increased production to 166 parts per hour, with closer tolerances, better finish and much easier operation.

It PAYS to come to Heald

HEALD®

**Borizing* is a copyrighted word meaning the application of any number or variety of precision finishing operations performed on a Heald Bore-Matic.*

THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

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Chicago • Cleveland • Dayton • Detroit • Indianapolis • New York

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MACHINERY

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The Monthly Magazine of Engineering and Production in the Manufacture of Metal Products

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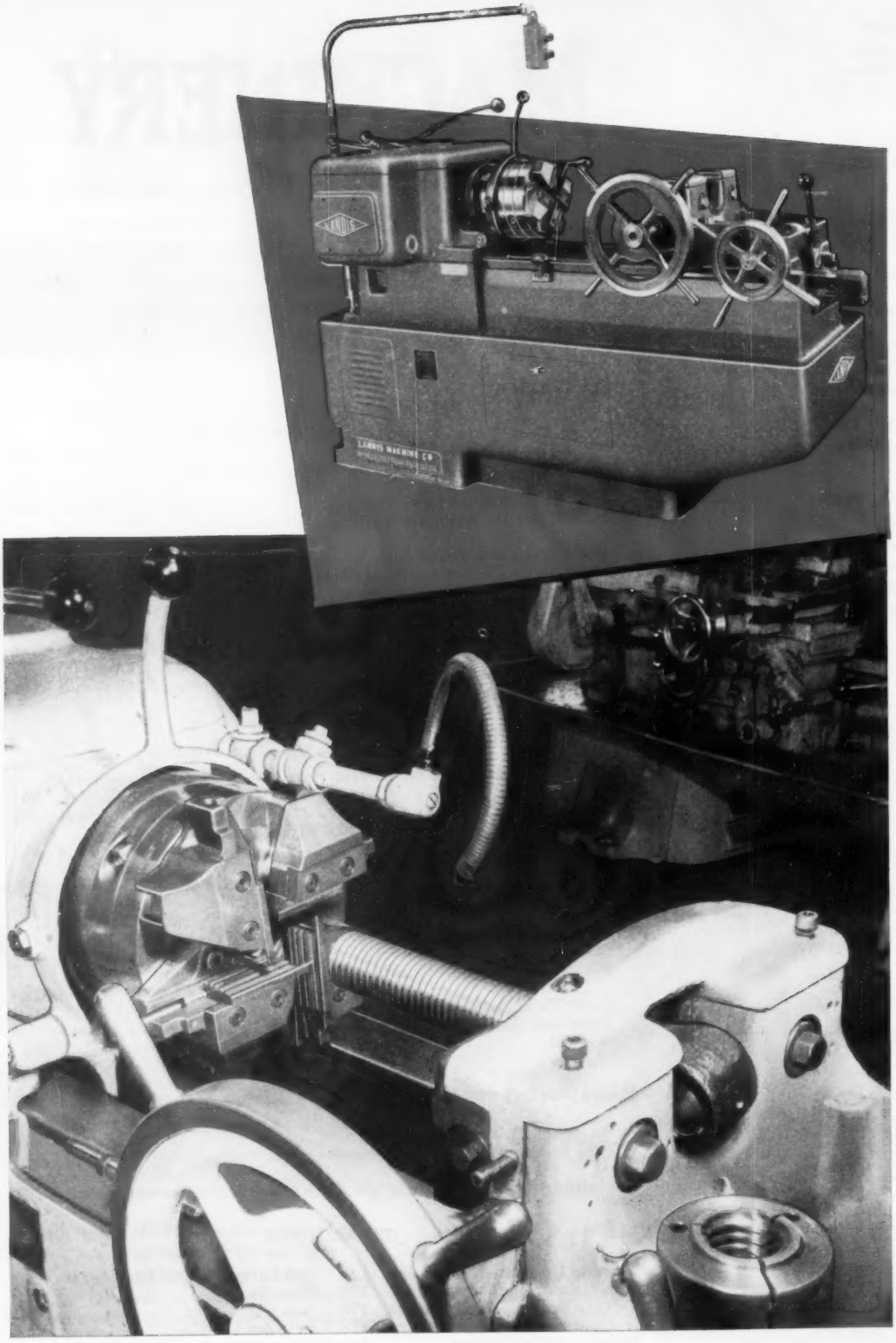


461-C

coarse threads

cut in one pass with LANDMACO machines

The cutting of large diameter Acme threads at the Iowa Manufacturing Co. of Cedar Rapids, Iowa, illustrates the heavy duty threading possible on LANDMACO Threading Machines.

1045 steel forgings of 20-29 Rockwell C are used in the production of adjusting screws for construction equipment. 2¼"-3 pitch Special Acme threads (EXTRA DEEP) are cut 10" long, with a .026 pitch diameter tolerance and a .001 per inch allowable lead error.

Cutting at a speed of 7.6 surface feet per minute, 12.5 pieces are completed per hour. This includes 100% gaging on the machine, using go-and-no-go gages. Despite the large amount of metal removal, at least 80 pieces are produced between chaser grinds.

This job is an excellent example how such heavy-duty threading can be done with the LANDMACO Machine. The 2½" Single Spindle Machine (½" to 2½" range) used here features heavy construction, hardened-and-ground ways, lead screw attachment, and is equipped with a rugged LANDMACO Tangential Chaser Die Head. Roughing-and-Finishing Centering Throat Chasers produce heavy cuts in one pass of excellent finish, eliminate the out-of-roundness common in long heavy workpieces, and provide low tool cost.

LANDMACO Machines offer precision and heavy duty threading within a range of #4 to 4" in diameter. For more detailed information, please send specifications when writing.

THE WORLD'S LARGEST MANUFACTURER OF THREADING EQUIPMENT - CUTTING - TAPPING - GRINDING - ROLLING

LANDIS Machine COMPANY | WAYNESBORO PENNSYLVANIA

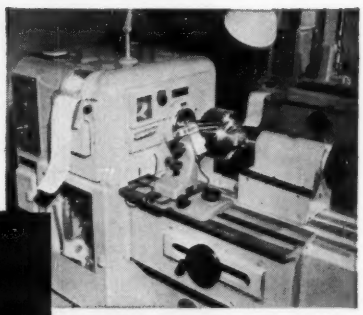
For more information fill in page number on Inquiry Card, on page 241

"PUTTING TEETH" IN

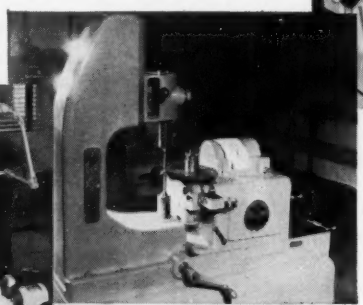
PHILADELPHIA GEAR WORKS INCORPORATED

Fellows 36-Type Gear Shapers at Philadelphia Gear Works: powerful, accurate and fast on long runs or special jobs.

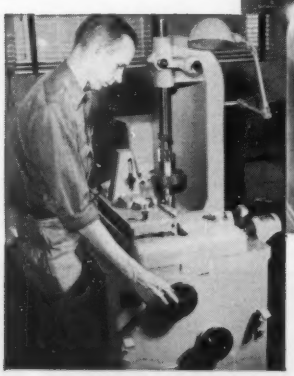
CUTTING / INSPECTION



Fellows No. 12H Lead Measuring Instrument checks lead, crown and taper and electronically provides charts of results for Philadelphia Gear.



Fellows No. 20M Red Liner automatically records all gear errors in combination, giving Philadelphia Gear a composite check on quality.



Fellows No. 12M Involute Measuring Instrument at Philadelphia Gear is simple to set up, checks involute profiles, and records any departure from specifications.

THE PRECISION LINE

phillie gear® STANDARDS

Integrated Fellows Gear Shapers and Inspection Instruments Assure Close-Tolerance Production

Consistently high quality is maintained at Philadelphia Gear Works by fast and accurate Fellows Gear Shapers teamed with Fellows Inspection Instruments. Inspection and recording by Fellows Instruments gives accurate warning of production errors and their nature, provides visible proof of gear quality. 'Phillie Gear' relies on Fellows equipment for producing gears for their famous Speed Reducers as well as many other industrial spur or helical gears.

Integrated production and inspection with Fellows equipment assures unified responsibility for meeting standards and precise quality control at lowest possible costs.

Ask any Fellows Representative for full information about the complete line of Fellows Gear Shapers, Shaving Machines, and Gear Inspection Instruments.

THE FELLOWS GEAR SHAPER COMPANY
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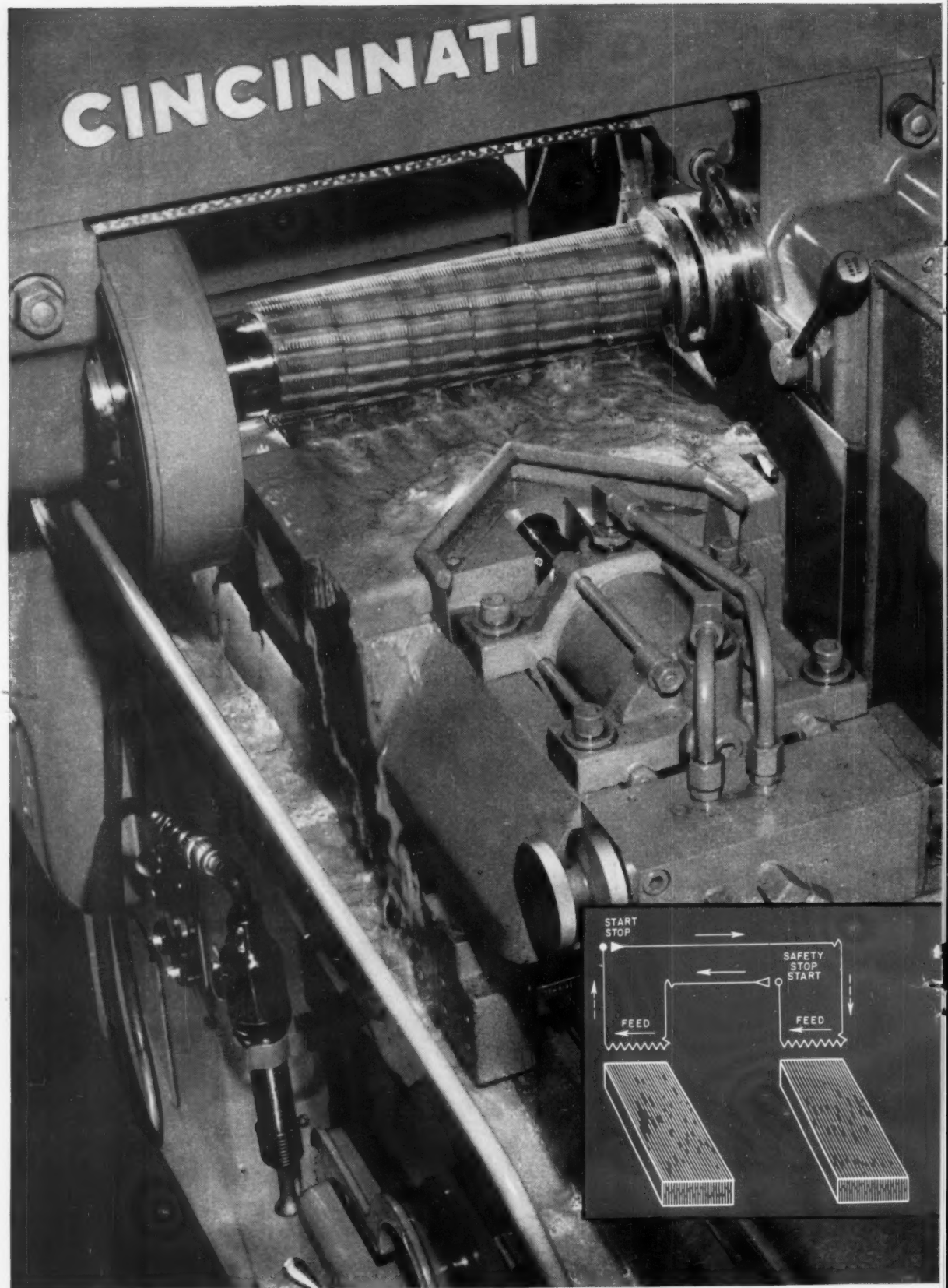
Branch Offices: 319 Fisher Building, Detroit 2
5835 West North Avenue, Chicago 39
150 W. Pleasant Avenue, Maywood, New Jersey
6214 West Manchester Avenue, Los Angeles 45

Fellows *Gear Production Equipment*


CINCINNATI
START
STOP
SAFETY
STOP
START
FEED
FEED

POWERMATIC

Lives Up To Its Name

Takes 14½" Wide Cut in One Pass

Combining a high percentage of usable power with automatic cycles is the specialty of Powermatic Milling Machines. The one illustrated here does the job to perfection for a prominent manufacturer of saw blades . . . **it takes a 10½" to 14½" wide cut in one pass, over two banks of parts, with automatic cycling of the table and spindle carrier.** ¶ This Powermatic is a plain automatic rise and fall style, 36" table traverse. Two hydraulic clamping fixtures with safety interlock, each holding 288 parts, are mounted on the table. The machine takes a "climb-milling" cut over both banks of parts, a distinct advantage in producing the same finish on all the parts. And because of the unique automatic cycle diagramed below, loading is accomplished while the milling cut proceeds. Cincinnati's exclusive Dynapoise overarm and a new type of vibration damping flywheel aid in producing a high-quality finish free of chatter and burrs.

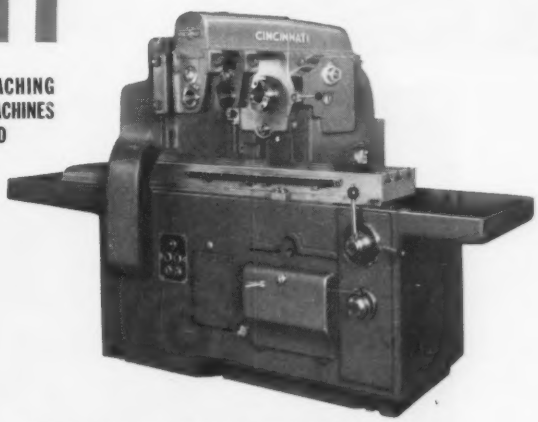
3700 saw blades are
produced per hour
at 87% operator efficiency

You may not be interested in the production of saw blades, but you will be interested in what makes this Powermatic setup a low-cost producer for similar work in your shop. Standard features include automatic backlash eliminator; automatic spindle stop; Dynapoise overarm; cycle selectors for automatic cycles. And Cincinnati engineering service is assurance of the most economical production of your components. Would you like to know more about CINCINNATI® Powermatic Milling Machines? You will find brief specifications in Sweet's. For complete data, write for catalog No. M-1913.

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO

CINCINNATI

MILLING MACHINES • CUTTER SHARPENING MACHINES • BROACHING MACHINES • METAL FORMING MACHINES • FLAME HARDENING MACHINES OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID



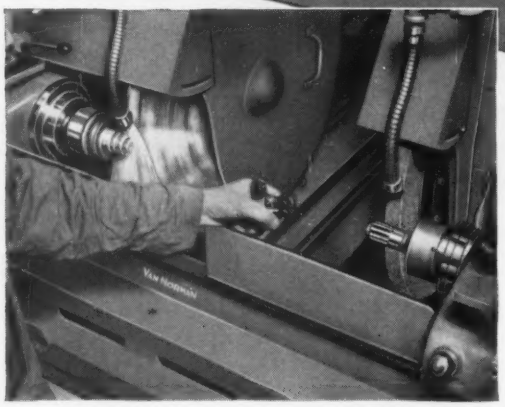
CINCINNATI POWERMATIC
Plain Rise and Fall Milling Machine.
Catalog No. M-1913.

The Powermatic automatic cycle diagramed at the left combines high production with high quality to mill the teeth in 3700 hack saw blades per hour. Rear view of the machine shows its comparatively small size for this titanic job.

CINCINNATI

VAN NORMAN

Van Norman "Bowgage" 4BG2 double head plunge cut chucking grinder. Capacity: 6" swing double work head. Grinding wheel: 30" x (¾ to 6) x (12 or 20). Grinding wheel motor: 10 to 20 H.P.



Grinding Universal joint flange on the Van Norman "Bowgage" 4BG2 — .022 stock removal — 1.625 diam. — 15 R.M.S. — Maximum 480 pieces per hour.

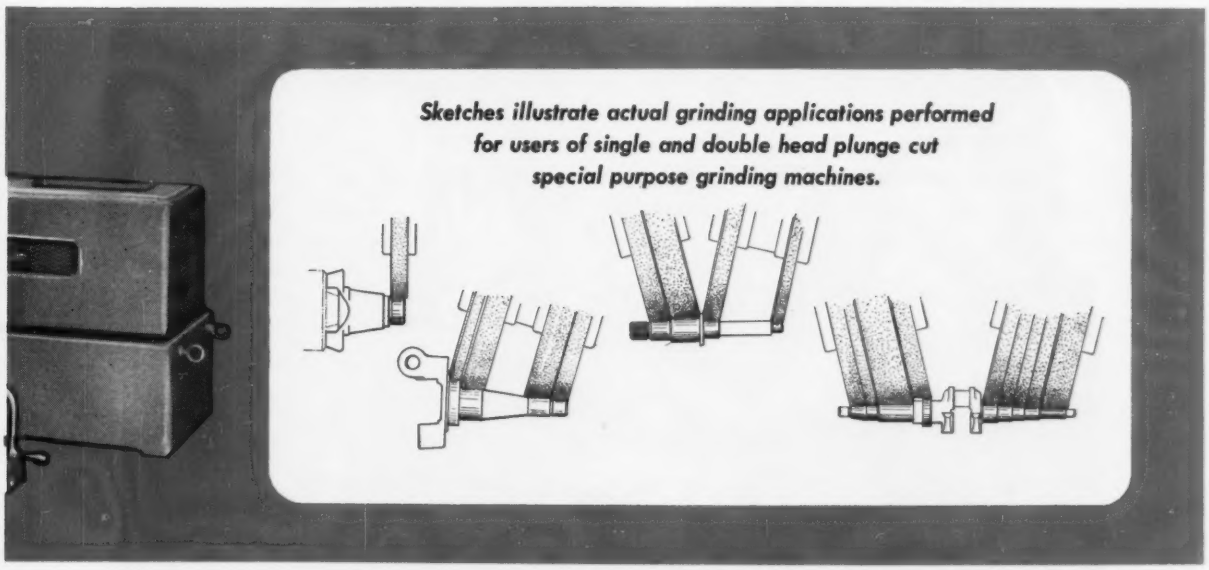
VAN NORMAN MACHINE

MANUFACTURERS OF — Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.

"BOWGAGE" PRODUCTION GRINDERS

"Engineered for the Job"

Outperform Them All For Speed, Accuracy and Low Cost Grinding



Sketches illustrate actual grinding applications performed for users of single and double head plunge cut special purpose grinding machines.

You just can't beat Van Norman "Bowgage" Production Grinders for fast, economical mass production. These massive, rugged grinders are "*engineered for the job*" to meet your exacting requirements.

Illustrated is the Van Norman "Bowgage" 4BG2 double head plunge cut grinder designed and built for a major automotive manufacturer. Day after day, this 14.8 ton rugged brute and other single and double head grinders are showing substantial savings by keeping production up and costs down.

If you have a mass production grinding problem, let Van Norman Engineers help you solve it. Write for their help, today.

**Don't wait . . . for extra profits install a Van Norman Machine now! They are available on five purchase plans — Outright sale . . . Purchase on conditional sales contract up to five years . . . Pay as you depreciate . . . Straight lease . . . Lease with option to buy. See your dealer or write Van Norman Company. Lease and Conditional Sales Contracts not available to Export.*

COMPANY | **SPRINGFIELD 7, MASSACHUSETTS**

Stationary and solidly supported work

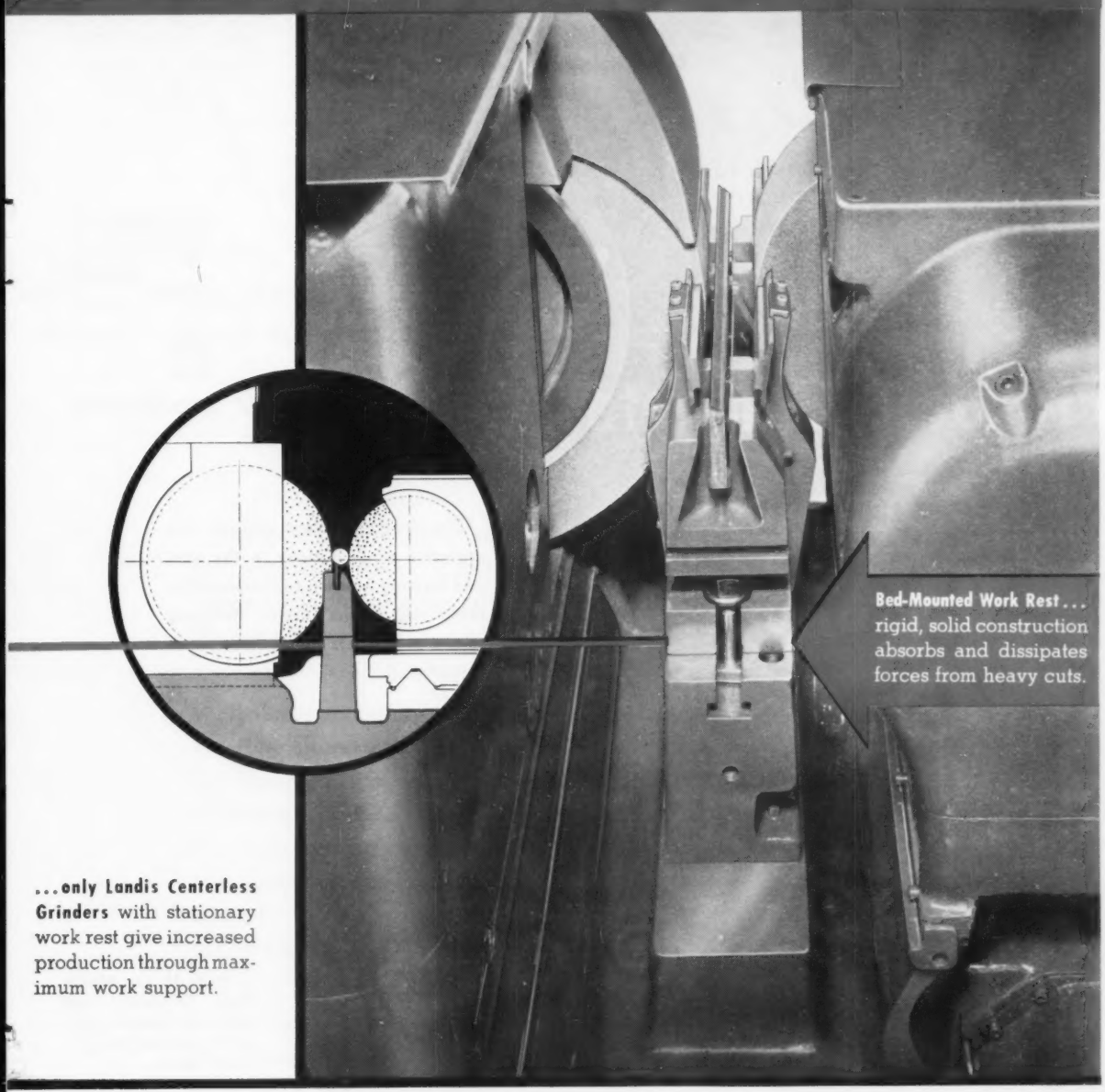
Gives finer finishes, greater precision with heavy cuts

Landis No. 12 Centerless
Send for new catalog T-55

LANDIS

precision grinders

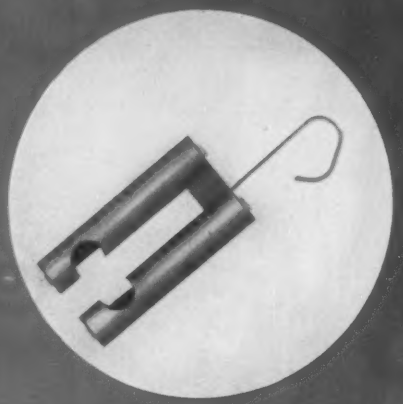
rest cuts centerless grinding costs



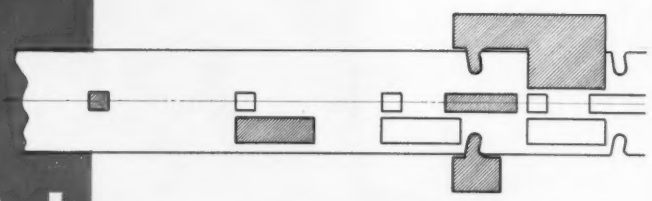
Bed-Mounted Work Rest... rigid, solid construction absorbs and dissipates forces from heavy cuts.

...only Landis Centerless Grinders with stationary work rest give increased production through maximum work support.

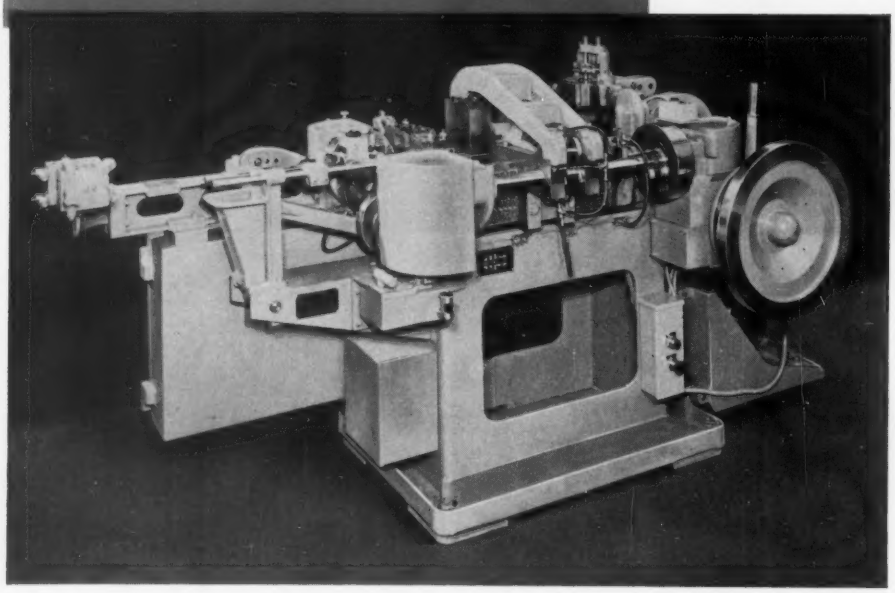
LANDIS TOOL COMPANY / WAYNESBORO, PENNSYLVANIA



Produced Complete! No Secondary Operations! on the U. S. MULTI-SLIDE®

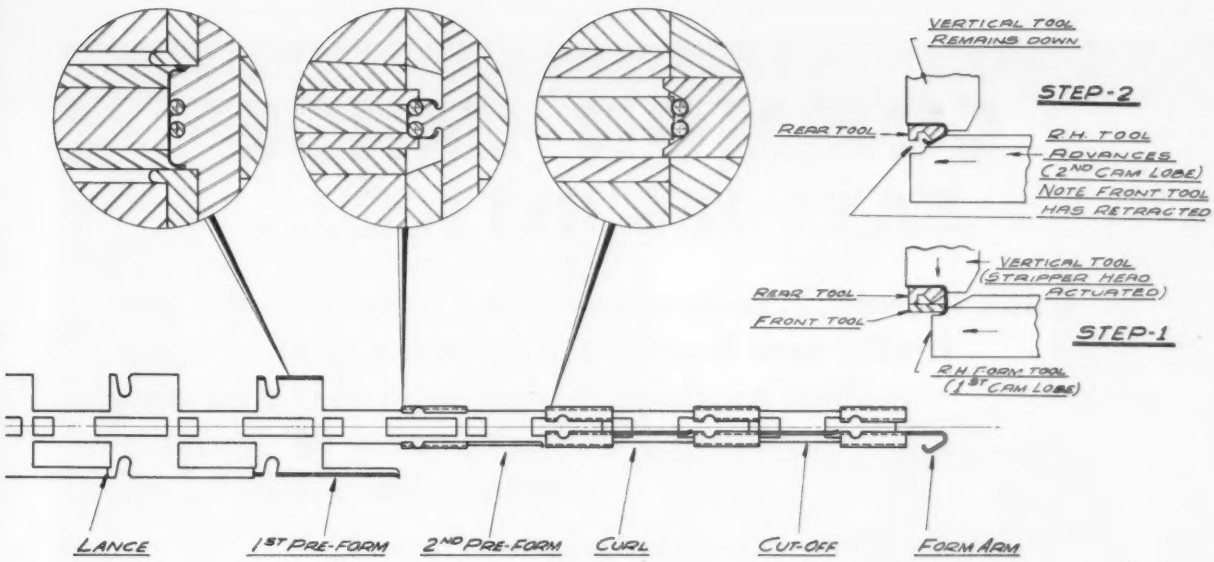


The drawings above indicate the sequence of operations in the dies and forming position to complete the intricately formed metal stamping shown to the left above (four times actual size).



#28 U. S. Multi-Slide Machine used with appropriate tooling to produce the part shown above.

U.S.



The intricately formed metal stamping (shown four times actual size on the opposite page), is just one of the many different types of stampings which can be produced without secondary handlings on the U. S. Multi-Slide.

Eliminate secondary operations—reduce costs—increase production: **You, like all manufacturers, are interested in achieving these results. In the pressroom this may be accomplished through the use of the U. S. Multi-Slide Machine. Standard machine equipment includes ram action, four slide forming position and vertical stripper movement. These various movements make the U. S. Multi-Slide a versatile machine and allow for the production of complicated formed metal stampings without secondary handlings.**

Ask for a copy of Bulletin No. 15-M which illustrates and describes these machines and contains the specifications for the four sizes now being built.

TOOL COMPANY, Inc.

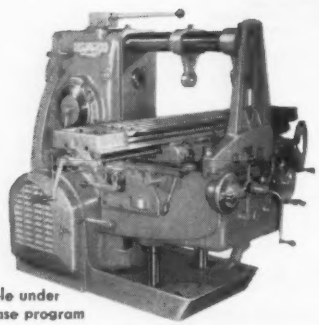
AMPERE (East Orange) **NEW JERSEY**

Builders of U. S. Multi-Slides — U. S. Multi-Millers

U. S. Automatic Press Room Equipment — U. S. Die Sets and Accessories

COMMON SENSE
SAYS IT'S BETTER...

Think it over... twin screw knee support is the one really new basic advancement in knee type milling machine design in years. And only Kearney & Trecker new TF Series machines have it!



Available under Tool-Lease program

TF Series Model 210 Plain Milling Machine

POWER — 10hp spindle drive; 3hp feed and rapid traverse drive
TABLE WORKING SURFACE — 62" x 14"
FEEDS — (32) ⅜ to 90 ipm
SPEEDS — (24) 15 to 1500 rpm
WEIGHT — 9200 lbs.

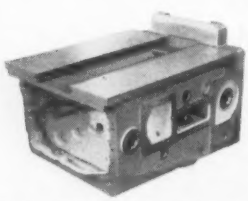
Here's why it makes sense.

Because the *twin screw* design distributes most effectively the weight of much larger, heavier knees, saddles and tables, it fulfills today's requirements for higher speeds, feeds and power — greater machine capacity. What's more, this *balanced design* substantially increases stability under heaviest loads... offers greater resistance to torsional thrust under all cuts... divides the wear factor in half, thus assuring greater, longer-lasting accuracy.

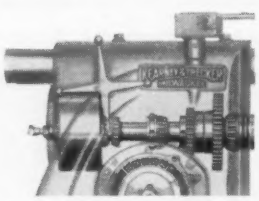
Kearney & Trecker's feature-packed TF Series line of general production machines is available in five sizes — No. 2 to No. 6, from 10hp to 50hp in Plain, Universal and Vertical styles.

Why take less than the latest when you want new milling machines? You can get all the facts on the new TF's from your Kearney & Trecker representative, or write direct to Kearney & Trecker Corp. Mail coupon for new catalog with details on TF Series machines.

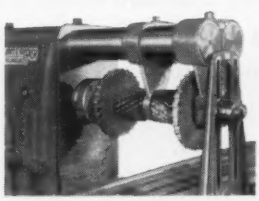
5 more reasons why TF Series milling machines are way out front in rigidity



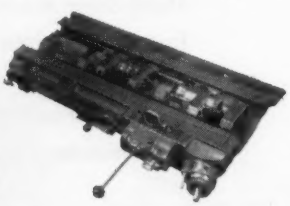
Heavier, Wider, One-Piece Knee — The *Twin Screw* arrangement supports the heavier, larger knee. Span and length of ways is increased considerably, providing fuller saddle support . . . longer-lasting accuracy.



Three-Bearing Spindle — Complete assembly consists of three heavy-duty bearings, fly-wheel, train of wide-faced forged steel gears. Rigidity of spindle unit contributes to increased cutter life and quieter operation.



Double "Vibra-Void" Overarms — Two solid steel bars, mounted completely through column, void vibration at source, afford more rigidity and resistance to deflection. Design also greatly simplifies changing of arbors and cutters.



"Fron-Trol" Operating Convenience — Front-mounted controls include feed selection, Mono-Lever table feed and rapid traverse, automatic cycle table feed and rapid traverse controls, table handwheel, levers for saddle clamping gib and backlash eliminator. All are grouped up front for easy operation. All machines are equipped with heavy-duty (2" dia.) table feed screw.

KEARNEY & TRECKER CORP.
6788 W. National Ave., Milwaukee 14, Wisconsin

Please send me Catalog No. TF-50 with details on the new line of TF Series Plain, Universal and Vertical milling machines.

Name.....

Title.....

Company.....

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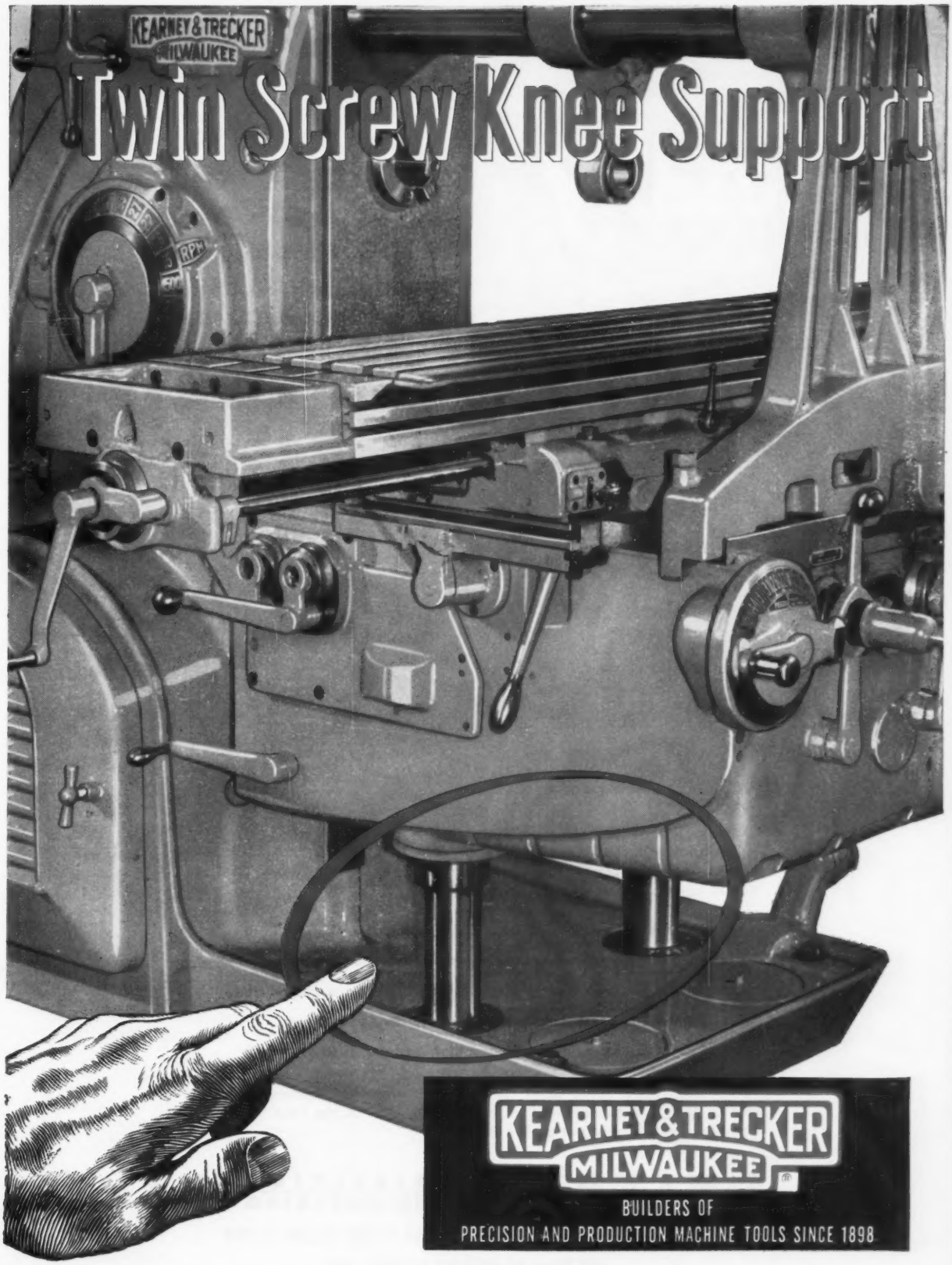
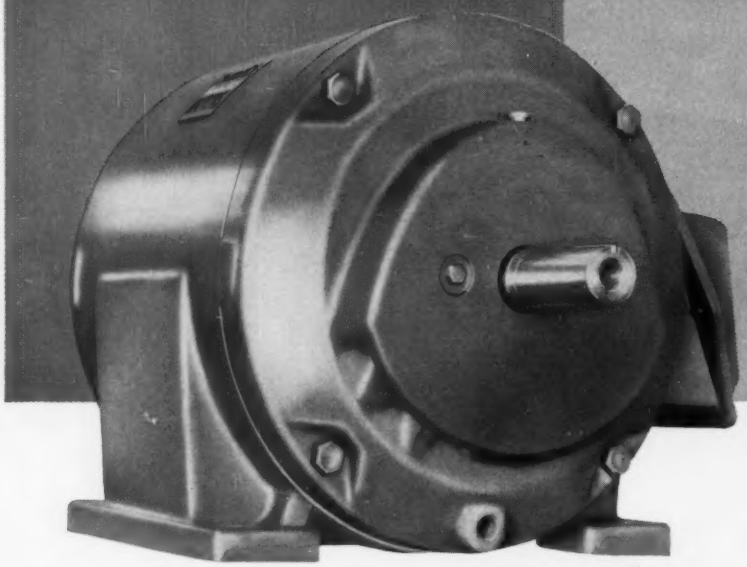
City.....Zone.....State.....

Massive Column — Solid back, double-box section column is scientifically ribbed throughout to rigidly withstand heaviest cutting forces. Full bearing column face affords maximum support for the knee. Cross-mounted motor assures maximum ventilation, easy access for routine maintenance.



For more information fill in page number on Inquiry Card, on page 241

Totally Protected



FROM CORE TO COVER

RELIANCE *Totally-Protected* MOTORS

The total protection concept of design and construction armors Reliance A-c. Motors against everyday hazards, with little or no maintenance. Total protection is made up of extra features like:

Slot cell insulation of Double Backed Mylar

Dynamically balanced rotor for vibrationless operation

Entire insulation system impervious to acids, moisture and oils

Metering plate regulates grease flow to bearing

Ventilation louvres positioned high and dry in end brackets

There are 100 of these extra core to cover protection features in Reliance Motors. Each point is covered in our bulletin, "Check the Facts". Why don't you write for one and get all the details?

B-1610

RELIANCE ELECTRIC AND ENGINEERING CO.

DEPT. 38A, CLEVELAND 10, OHIO • CANADIAN DIVISION: WELLAND, ONTARIO

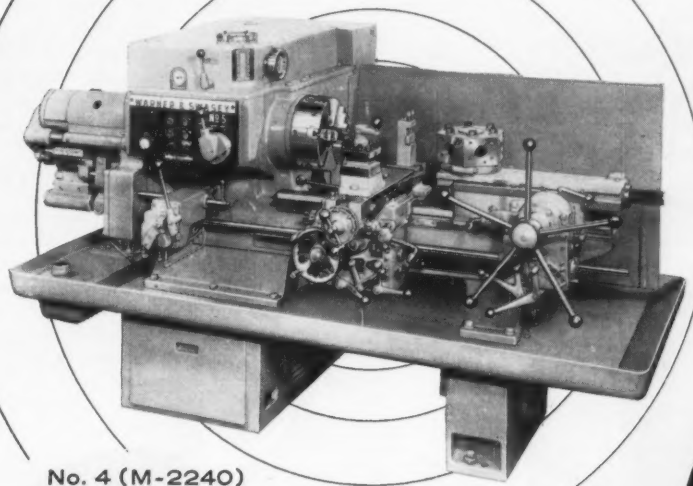
Sales Offices and Distributors in Principal Cities

On new Warner & Swasey No. 4 and No. 5 Turret Lathes with new all-hydraulic headstock...

YOU CAN CHANGE SPEEDS

FASTER THAN YOU CAN

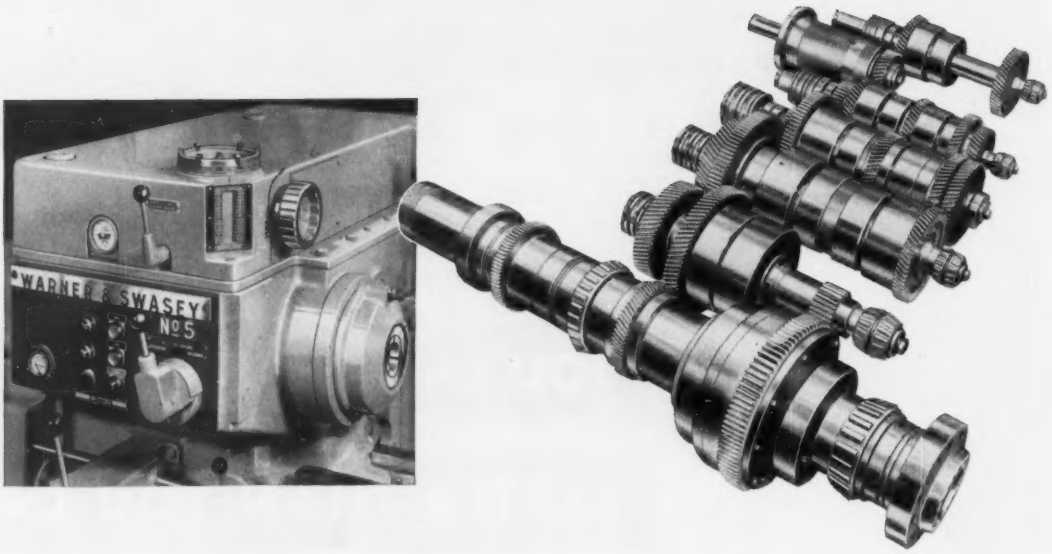
TURN THIS PAGE!



No. 4 (M-2240)
2" Bar Capacity—18⅛" Swing

No. 5 (M-2250)
2½" Bar Capacity—20" Swing

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880



INSTANTANEOUS SPEED CHANGES

WITH THE FLIP OF A LEVER

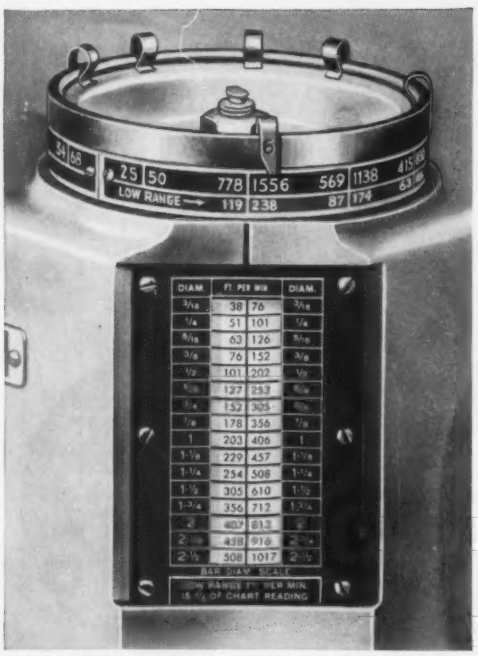
DIRECT-ACTING hydraulic clutches, with a constant-mesh gear train, eliminate all gear shifting on these new Warner & Swasey Ram Type Turret Lathes. Clutches engage smoothly and quickly, providing fast starts, stops, and reverses. Clutches never need adjustment.

With the patented speed preselector the operator can select a new spindle speed while under cut and with a mere flip of a lever, change speeds instantly.

A flip of the speed change lever in the opposite direction provides a valuable 6 to 1 speed reduction for threading or forming cuts—instantly and without preselection.

A total of 12 spindle speeds, or 24 unduplicated speeds with a two-speed motor, are available on these new machines. A touch of a button doubles or halves the speed, and when used in conjunction with the 6 to 1 speed change, four spindle speeds are instantly available with only one setting of the preselector.

A separate master lever controls forward, reverse, brake and neutral. *Zoned controls* on headstock and apron put them all within easy reach of the operator—cutting fatigue, speeding his work, putting more pieces on the floor every hour of every day!



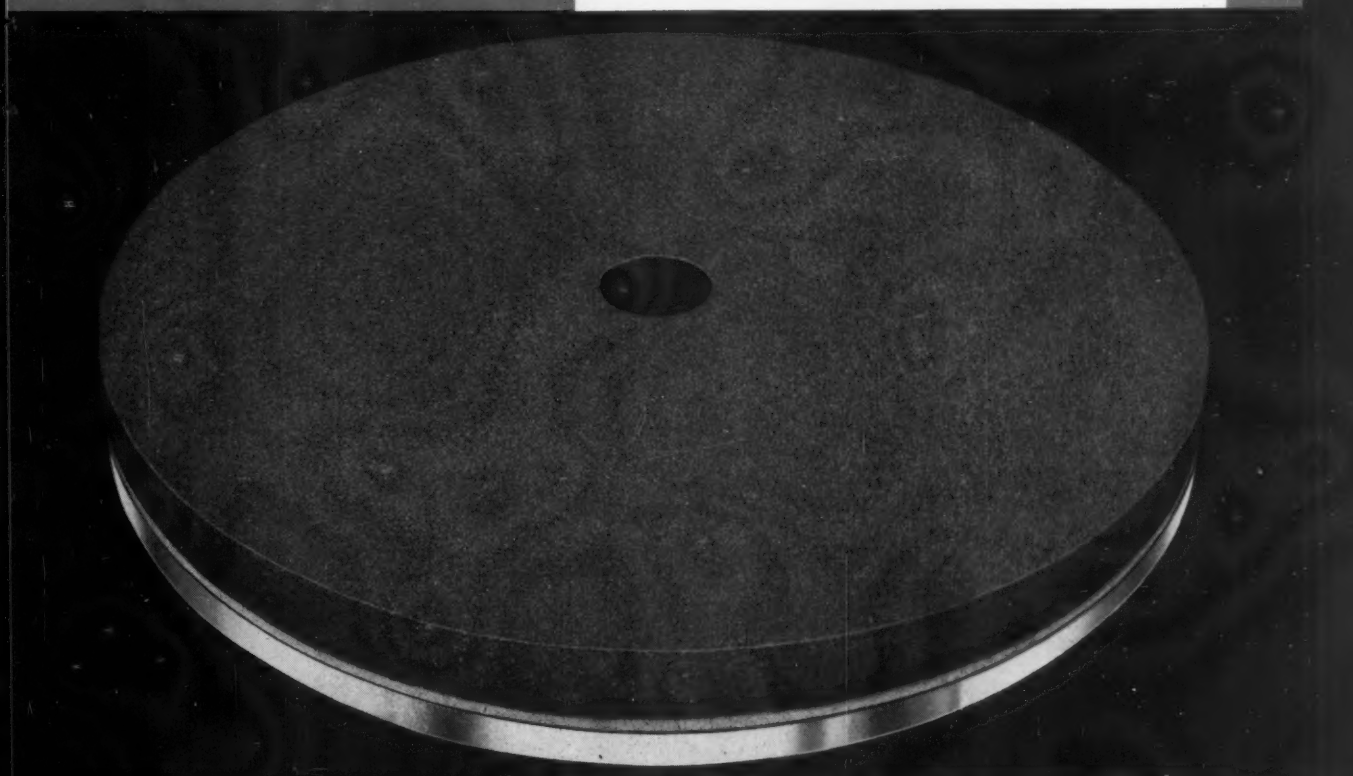
Warner & Swasey's direct-reading, patented speed preselector is calibrated in work diameter, surface feet, and spindle rpm's—which, with the new ease of changing speeds, encourages the operator to use the proper spindle speed.

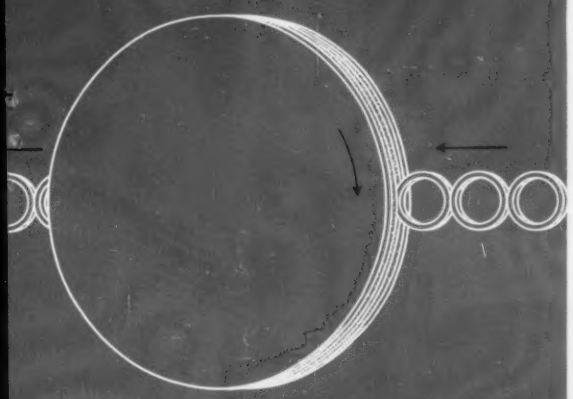
WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS...WITH A WARNER & SWASEY

46% more disc life after changing to Gardner

Reduces down time, lowers unit cost





Precision grinding both sides of bearing races in one operation.

the problem:
To increase disc life in double disc grinding parallel sides of bearing races of various sizes.

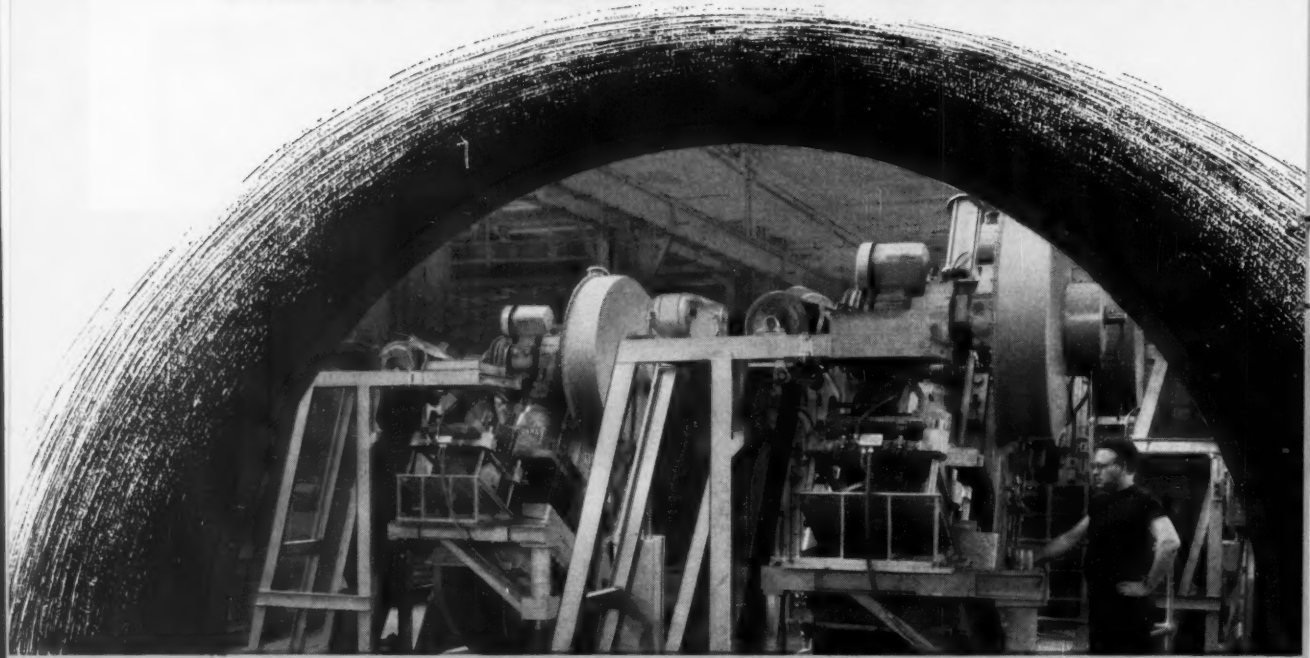
the solution:
Gardner Abrasive Specialist recommended new specification which produced an average of 280,000 pieces per set of discs, compared to 191,000 per set of discs previously used.

GARDNER

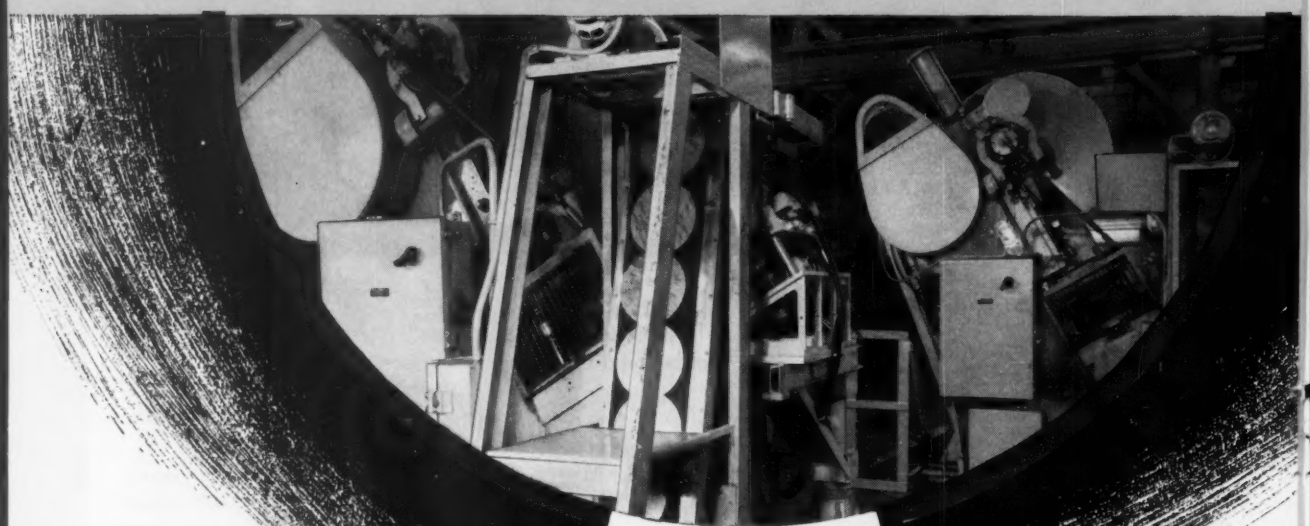
abrasive discs

BELOIT, WISCONSIN

keyhole view of key operations in . . . . .

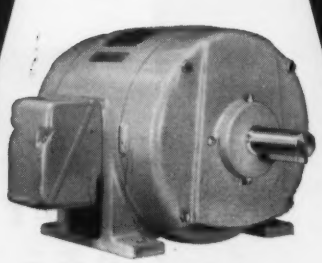


4 NIAGARA AUTOMATIC OBI's PUNCH OUT



(Upper)
Two Niagara OBI's operate on each of the two G-E automated production lines at Building 85.

(Lower)
Fully automatic, 4 Niagara OBI's are fed by magnetized conveyor belts. Stator punchings leave press on upper conveyor and rotor punchings on lower, at rear of press. Scrap is discharged to under-floor conveyors.



Tri-Clad® '55' Motors such as this are manufactured in Building 85.

GENERAL ELECTRIC'S "SUPER SECRET" BLDG. 85 WHICH CUT MOTOR PRODUCTION TIME FROM 2 WKS. TO 24 HRS.

Strictly "hush-hush" for its first year and a half of operation, General Electric's now widely publicized Building 85 in Schenectady gives the rest of the metalworking industry plenty of food for thought.

Chopping down production time of 7½ - 30 hp induction motors, from 2 weeks to 24 hours, is no mean feat. G.E.'s medium induction motor department has done it with the very latest ideas in mechanized fabrication.

Helping to perform the important job of punching out lamination blanks for stators and rotors are 4 fully automatic Niagara OBI Presses. Each is equipped with General Electric ACA adjustable speed drives for maintaining flexibility in the flow of parts to meet market demands for 100 standard motor models . . . the very feature that Building 85 is famous for: *Variety and Automation, too!*

Fitting perfectly into the scheme of things at this, the most modern of electric motor plants, Niagara OBI's operate on fully automatic cycles. Automatically fed by magnetized conveyor belts, they likewise discharge their work automatically to the next operation. Metal waste is removed by under-floor conveyors.

Tough assignment for an OBI? Not for a Niagara! On last report, G.E. was getting 100,000 punchings per press from each set of dies

ROTOR AND STATOR LAMINATION BLANKS

between re-grinds. Longer die life is one of the assured benefits from the rugged, rigid, all-welded steel Niagara frames.

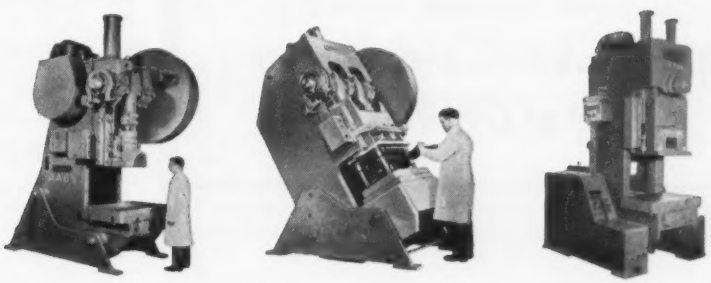
Pacemaker of the press industry, Niagara has the most to offer in OBI's . . . whether it's the Single Crank Electro-Pneumatic Clutch type used in this G-E plant, the Double Crank type for long die area work or the revolutionary new Front-to-Back Crankshaft design in automated or standard models. Now that you have the G-E story, get the whole Niagara story, too. Request literature.

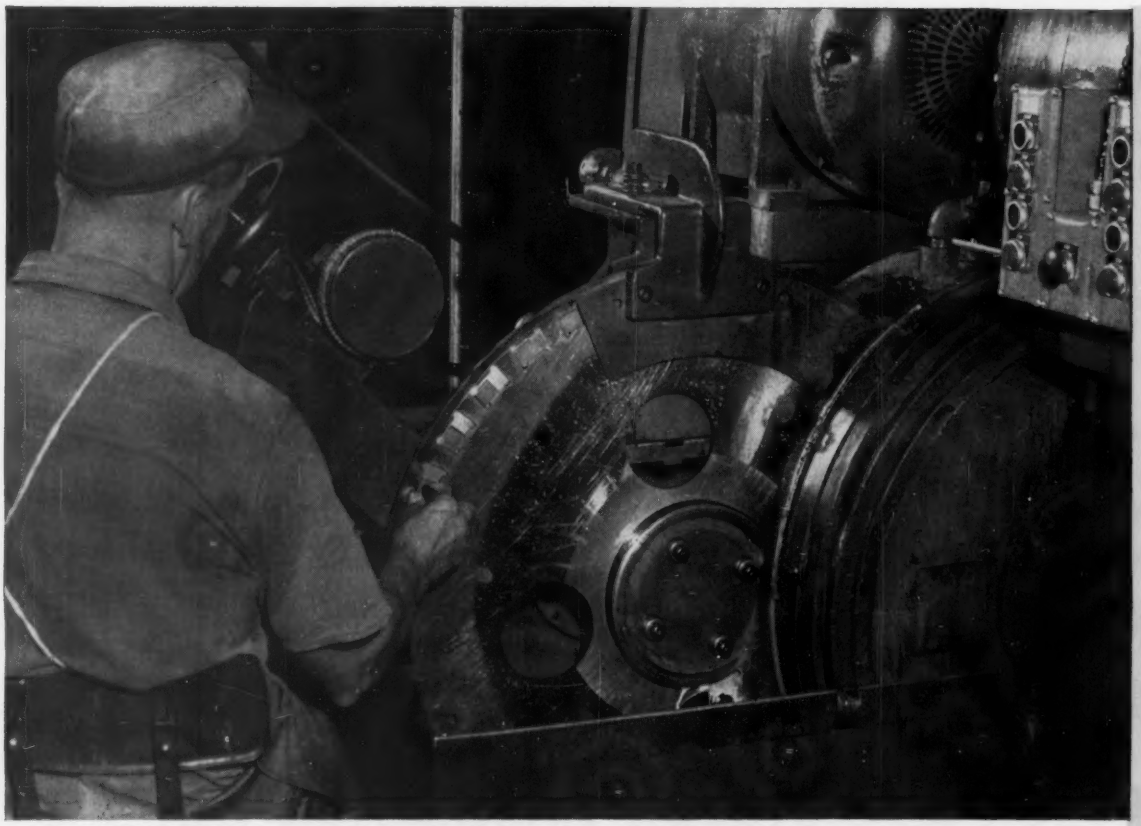
NIAGARA MACHINE & TOOL WORKS • BUFFALO 11, N. Y.

DISTRICT OFFICES: Buffalo • Cleveland • Detroit • New York • Philadelphia

Dealers in principal U. S. cities and major foreign countries

NIAGARA OBI PRESSES





HEAVY STOCK REMOVAL with precision tolerance on this double spindle disc grinder is a faster, easier job when a Norton disc adds the "Touch of Gold." Norton covers the entire range of disc grinding applications, from snagging to lapping.

"We find Norton discs outproduced others 2 to 1"

One of many job reports showing how Norton discs add the profit-boosting "TOUCH of GOLD"

MORE OF THE SAME:

- "Norton discs the best ever received. Produced over 6,000,000 piston rings — 100% more than our former discs, with 50% less dressing. Results duplicated in subsequent shipments."
- "Outlasted and outperformed all other discs. Gave 366,975 pieces without burn."
- "Averaged 21,500 pieces, a new high for this job."
- "High above competition for output and grinding quality."
- "Gave 20% longer service life."

What Norton discs have done for others, they can do for you.

That goes for any material you're grinding, on any type of disc grinding machine.

LAPPING ENDS OF TRANSFORMER COILS on a Norton 60-F HYPRO-LAP* lapping machine equipped with a Norton disc. Only Norton offers you such long experience in both grinding wheels and grinding machines to help you produce more at lower cost.

Norton discs of ALUNDUM* and CRYSTOLON* abrasives are made in all standard grit sizes, all grinding grades, five types of bonds and all types of mountings. They are precision-built for closest uniformity — so you can depend on the same cool cutting action and extra long service life every time you re-order.

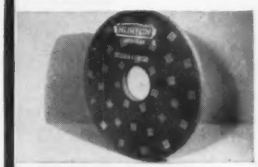
See Your Norton Distributor

for valuable aid in selecting the right discs for your jobs. Ask him for the booklet, *Disc Grinding*. Or write to the nearest district office of NORTON COMPANY, Worcester 6, Mass. Distributors in all industrial areas, listed under "Grinding Wheels" in your phone book, yellow pages. Behr-Manning Company, Troy, N. Y., division of Norton Company. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Mass.

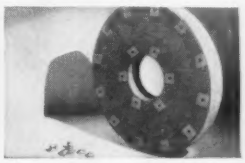
W-1723

*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries

For Every Job — Norton discs are made in all types of mountings, six of which are shown here.

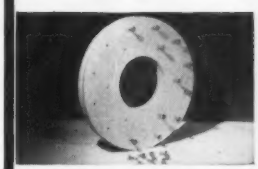


Resinoid (Inserted Nut)



Vitrified (Inserted Nut)

Silicate (Inserted Nut)



Solid Plate Mounted (Projecting Stud Type)

Solid Plate Mounted (Loose Screw Type)

Segmental Plate Mounted

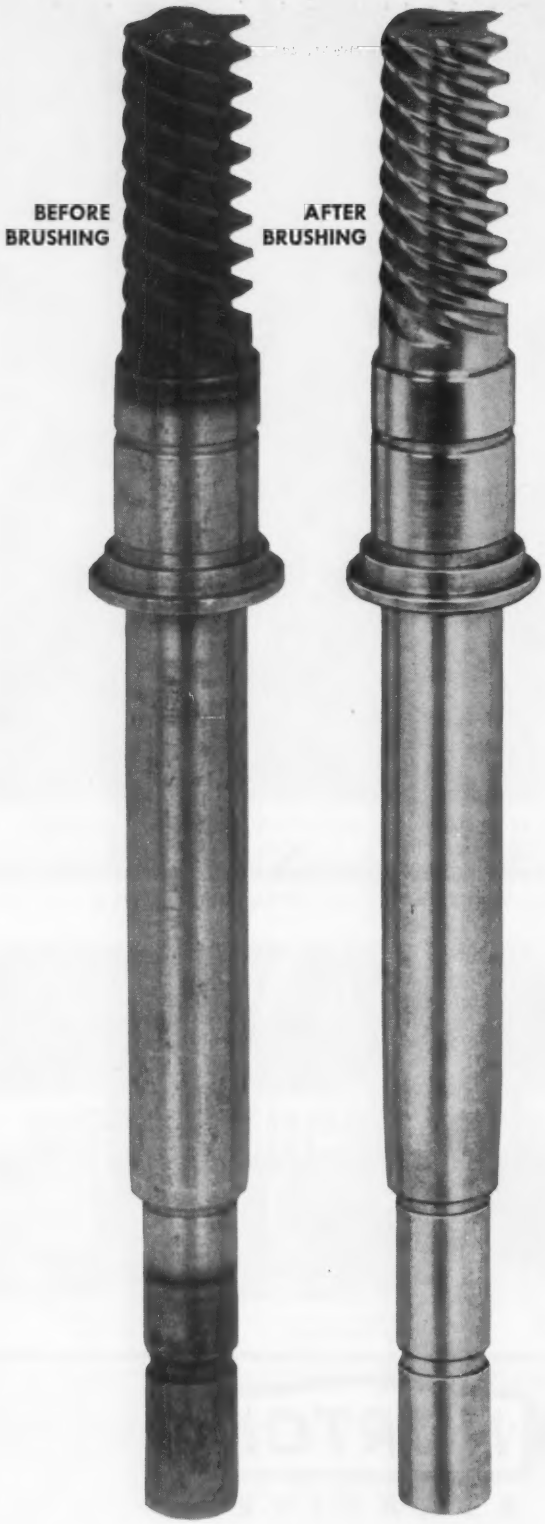
NORTON

ABRASIVES

Making better products . . . to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Grinding Machines • Refractories

BEHR-MANNING PRODUCTS: Coated Abrasives • Sharpening Stones • Behr-cat Tapes

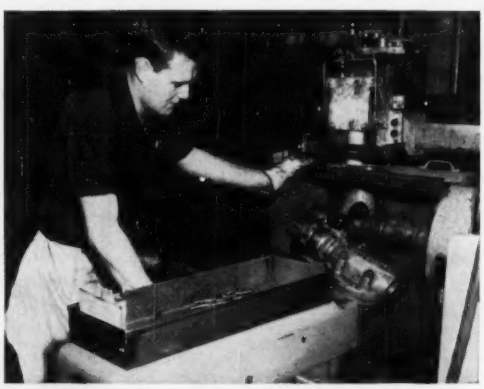


7 finished for the price of 1

COMPLEX business machines have as many as 25,000 moving parts. Although most of these parts must meet exceptionally high quality standards, production economy is also an imperative consideration.

Take the armature shaft shown on the left, as typical. Osborn Brushamatic® methods improve the finish of the worm gear from an original 30 down to 4 micro-inches, at ⅓ the cost of the former method. *Seven parts finished for the price of one.*

An **O**sborn **B**rushing **A**nalysis, made at no obligation to you, will point out how *you* can use Brushamatic finishing to achieve similar results and savings. Write *The Osborn Manufacturing Company, Dept. D-44, 5401 Hamilton Avenue, Cleveland 14, Ohio.*



Major manufacturer of business machines uses six different Osborn Brushamatic® 3-A machines to finish parts in lot quantities of 300 to several thousand.

Osborn Brushes

OSBORN

BRUSHING METHODS • POWER, PAINT AND MAINTENANCE BRUSHES
BRUSHING MACHINES • FOUNDRY MOLDING MACHINES

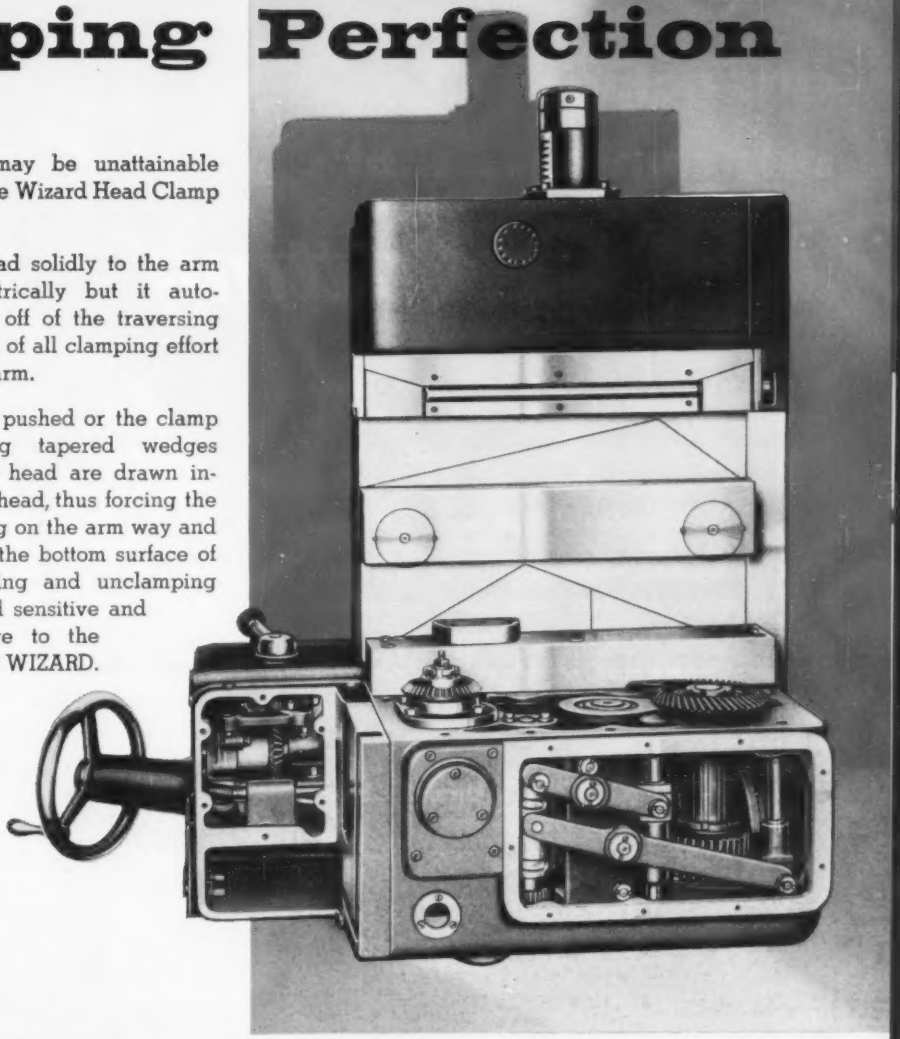
For more information fill in page number on Inquiry Card, on page 241

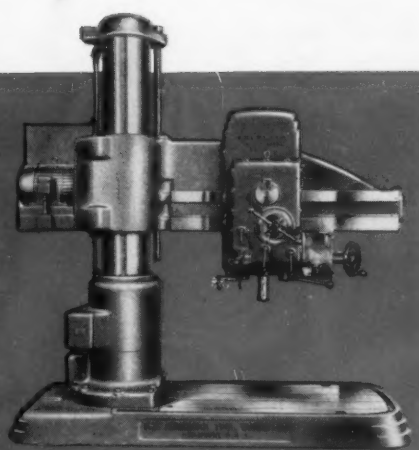
Clamping Perfection

Theoretically perfection may be unattainable but practically the new Hole Wizard Head Clamp is perfect.

It not only clamps the head solidly to the arm either manually or electrically but it automatically raises the head off of the traversing rollers, thus relieving them of all clamping effort and binds it solidly to the arm.

When the clamp button is pushed or the clamp lever actuated, opposing tapered wedges between the arm and the head are drawn inwardly at each side of the head, thus forcing the head off of its roller bearing on the arm way and wedging it solidly against the bottom surface of of the arm. This clamping and unclamping action is instantaneous and sensitive and adds another plus feature to the "AMERICAN" NEW HOLE WIZARD.





Plus features

Speaking of Plus Features here are a few you will want in your next radial.

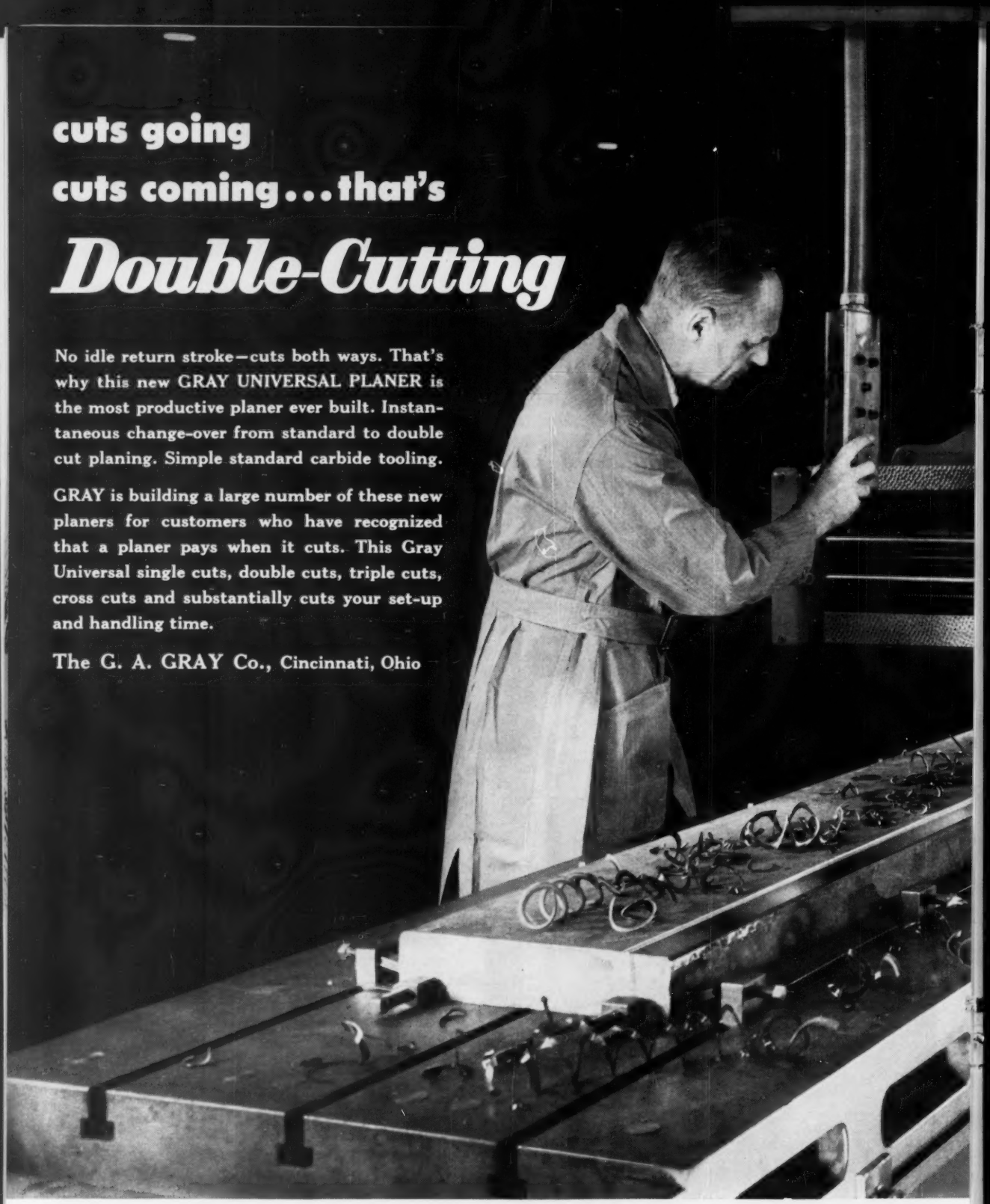
- Centralized Control.
- Lightning-fast Direct Reading Speed Change.
- Nitrided Spindle and Sleeve—practically wear proof.
- Timken mounted column unit defies deflection.
- Raybestos covered, spring steel tapping attachment friction bands, quick acting, wear proof, permitting 40% speed-up for spindle reverse.

These are just a few . . .
learn the others from bulletin No. 328

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

cuts going
cuts coming... that's
Double-Cutting



No idle return stroke—cuts both ways. That's why this new GRAY UNIVERSAL PLANER is the most productive planer ever built. Instantaneous change-over from standard to double cut planing. Simple standard carbide tooling.

GRAY is building a large number of these new planers for customers who have recognized that a planer pays when it cuts. This Gray Universal single cuts, double cuts, triple cuts, cross cuts and substantially cuts your set-up and handling time.

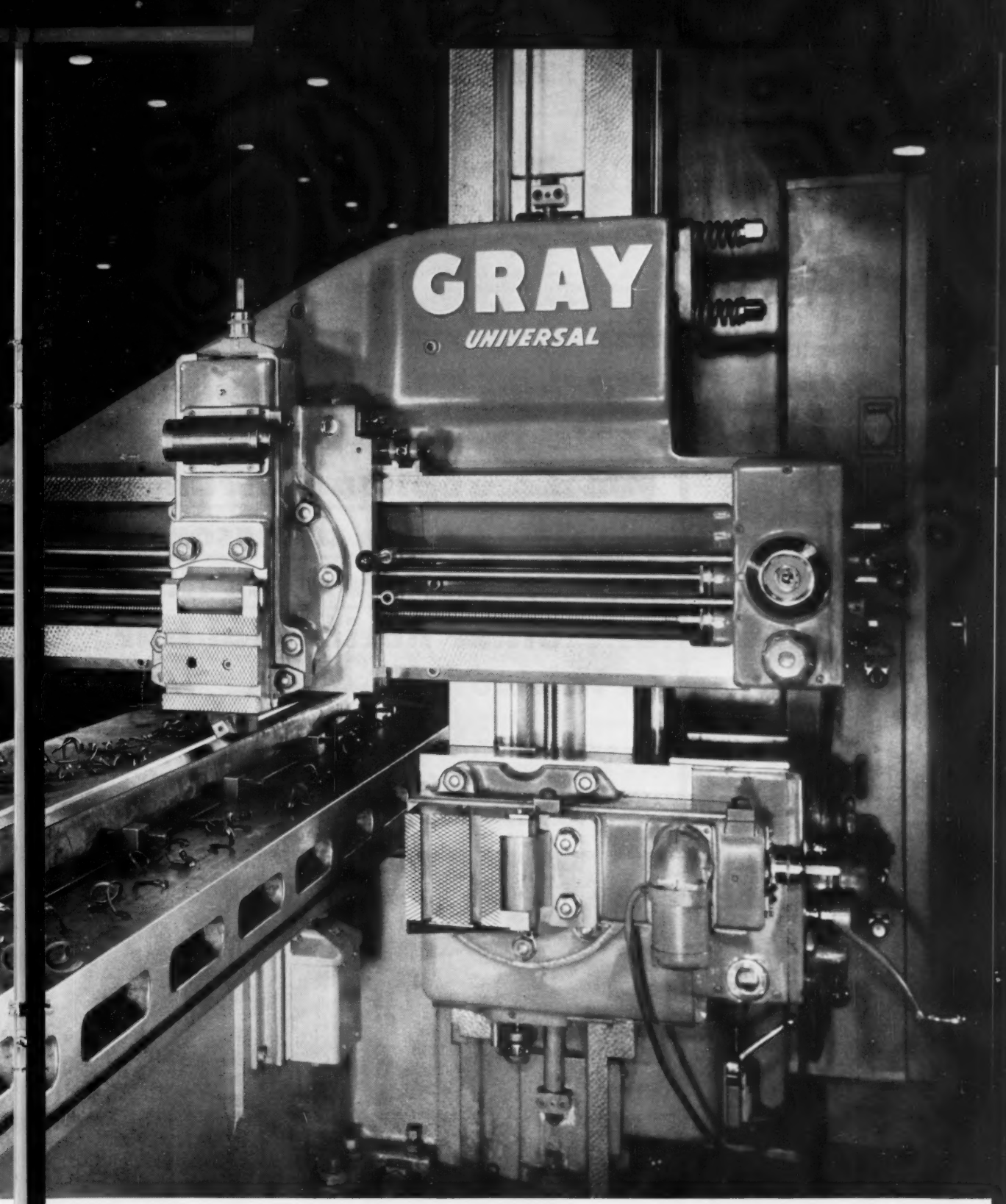
The G. A. GRAY Co., Cincinnati, Ohio

heavy-duty planing

The Gray Universal is the world's most powerful planer available for conventional planing. Its rigidity and speed are ideally suited for modern carbide cutting.

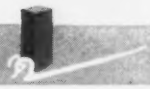
double cut planing

The flick of a lever, the touch of a button permits double cutting. Elimination of the idle stroke insures the world's most efficient flat surface machining. Only simple carbide tools are required.



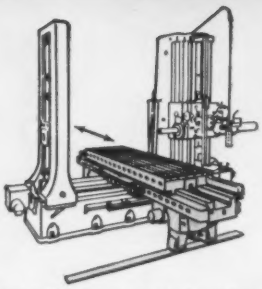
triple cut planing

Rough and rough-finish plane at the same time. Rough by double cut planing and simultaneously rough-finish with a single point tool. Then finish plane without a tool change.

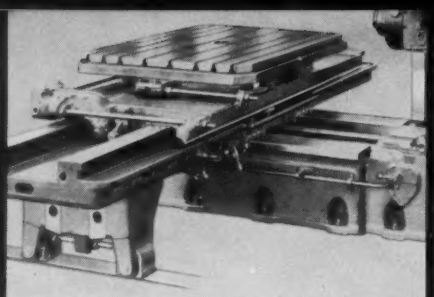


cross planing

Eliminates extra settings by cross planing the occasional keyways, chamfered corners, and other troublesome small cross surfaces that formerly added hours to your set-up time.

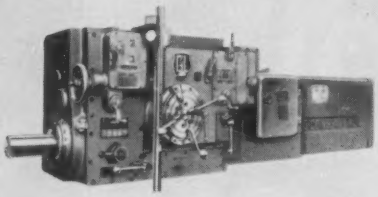


Increased table sizes, extended saddles, saddle supports and auxiliary runways — foundations in-the-floor or over-the-floor types.

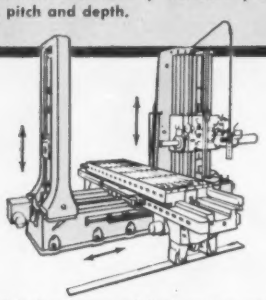


Built-in rotary tables with power milling feeds available with round, square or rectangular platens in various sizes.

Auxiliary combination plain and hand feed rotary tables available with round, square or rectangular platens in various sizes.



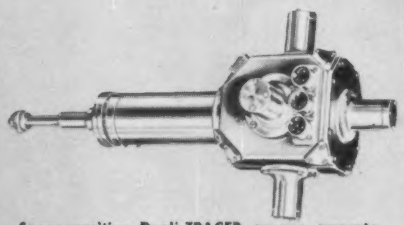
Built-in thread lead device permits cutting of precision threads to any standard prescribed form, pitch and depth.



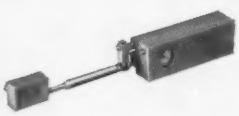
Full ribbed column and bed assures maximum rigidity. Machines available in various increased column and end support heights plus increased bed lengths.

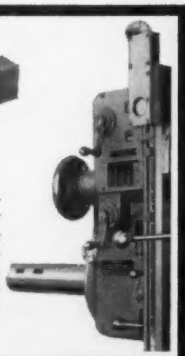
Giddings & Lewis 30 Series table-type machines give you more optional arrangements . . . more accessories . . . more attachments than any other horizontal bar in the world!

• For complete specifications on G&L 30 Series Table-Type Horizontal Boring, Drilling and Milling machines ask for Bulletin No. 345.

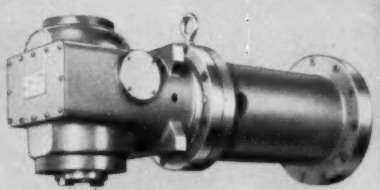


Super-sensitive Dupli-TRACER assures accurate 2- or 3-dimensional stepless contour tracing and 360° profiling. Another important feature is a manual steering control.

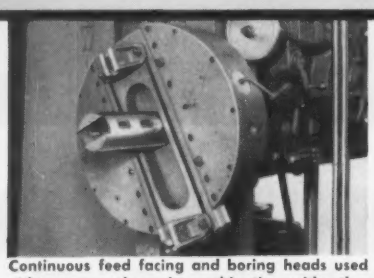




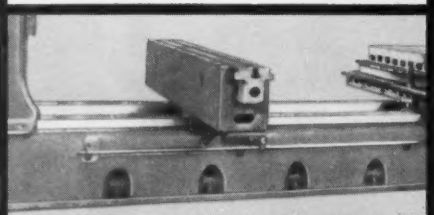
Automatic, electrically-operated positioning device for both headstock and table travel assures accurate machine settings repetitive to .0002" . . . eliminates time-consuming fine hand adjustments.



Heavy-duty, single-spindle, angular milling attachment operates at right angles to machine spindle. Offers unusual flexibility for machining hard-to-reach surfaces.

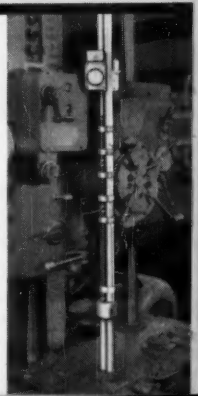


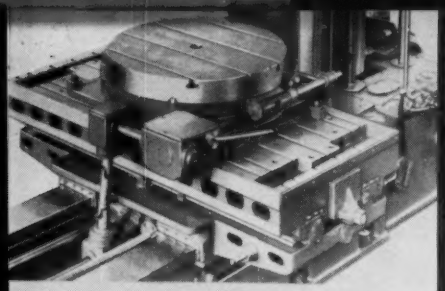
Continuous feed facing and boring heads used either separately or in combination with other attachments or accessories for turning, facing, threading, back facing, grooving, etc. Telescopic, right angle and facing tool holders, and high speed grinder are also available.



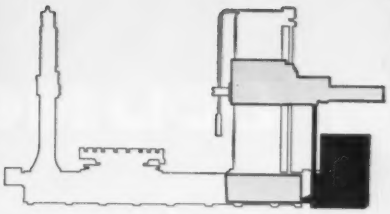
Plain or sliding platen auxiliary tables, mounted between table and end support, add extra rigidity in machining long workpieces which overhang the width of table.

Improved measure device, used in conjunction with precison end measure rods (complete sets or individual units) is employed where extreme accuracy is required — readings to .0001". Device includes vertical and horizontal measuring unit to indicate vertical travel of headstock . . . cross travel of table on saddle . . . also for transverse saddle movement.

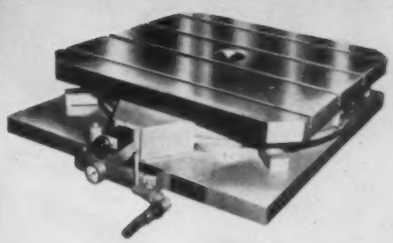




Auxiliary combination plain, hand and power take-off feed rotary tables available with round, square and rectangular platens in various sizes.



The exclusive G&L "Lubri-Cool" system, shown connected to headstock and milling feed unit, assures machining accuracy under heavy loads and in ambient temperatures.

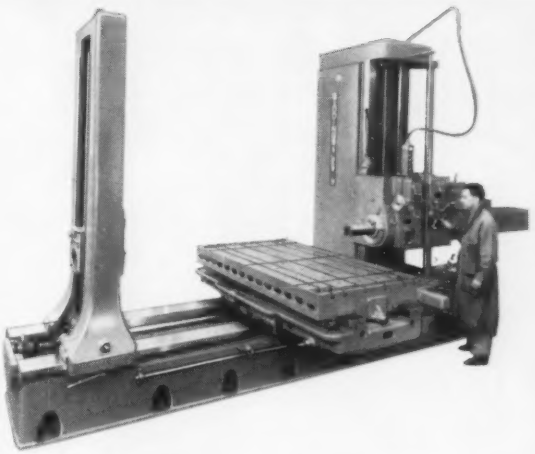


New G&L Air-Lift rotary table literally "floats on air." Capable of 360° indexing off center loads . . . eliminates multiple setups. Available with round, square or rectangular platens.

Here's why the world's favorite, profit-making Horizontal Boring, Drilling and Milling machines are Giddings & Lewis 30 Series, table-types — Model 340-T with 4" dia. spindle (20-hp motor) and Model 350-T with 5" dia. spindle (25-hp motor). It's because of their ability to be adapted to handle an extremely broad range of work when equipped with any of a big variety of optional equipment, attachments and accessories.

Year in and year out these machines continue to offer you more new features — such as the exclusive "Lubri-Cool" system. You'll discover too, that no other machine on the market today offers you so many distinct performance and capacity boosting features for boring, drilling and milling.

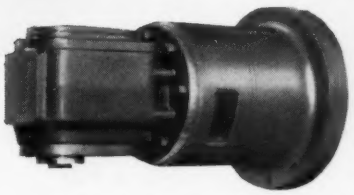
Yes, there's no better time than now to find out how much more work these machines can do in your shop. Contact your Giddings & Lewis representative today. He'll be glad to give you all the facts.



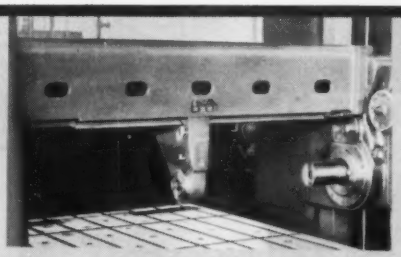
G-58

G & L *and* HYPRO DIVISION
GIDDINGS & LEWIS MACHINE TOOL CO.
FOND DU LAC, WISCONSIN

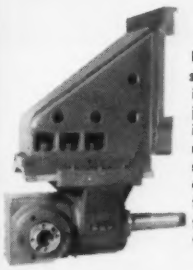
Builders of the world's finest heavy-duty Horizontal Boring, Drilling and Milling Machines—table, floor and planer types; HYPRO Double Housing and Open Side Planers, Planer Type Milling Machines and Vertical Boring Mills; Vertical Turret Lathes; Spar and Skin Milling Machines, and VARIAX machines.



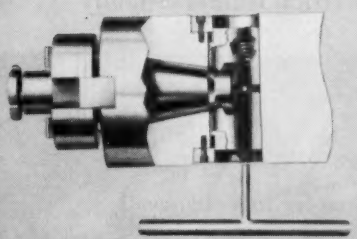
Heavy-duty, two-spindle angular milling attachment handles heavy cuts with high power outer spindle. Medium-duty inner spindle used for a wide range of drilling, boring, light milling and other work.



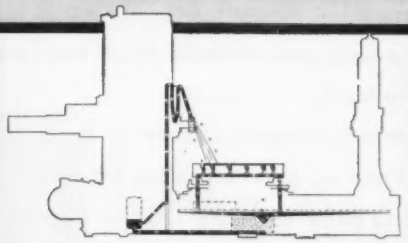
Cross-rail type arbor support in various lengths permits setting of milling cutters at any position over the table. It's ideal for slab, gang and straddle milling operation.



Right angle, heavy-duty sliding-head angular milling attachment with adjustable overarm support is practical for heavy milling, boring, drilling, reaming, etc. Medium-duty unit also available for machining at any angle in large openings and cavities.



Optional Quick-Change or Morse taper spindles available. Quick-Change spindle positively retains or ejects cutting tools by means of a simple wrench adjustment.

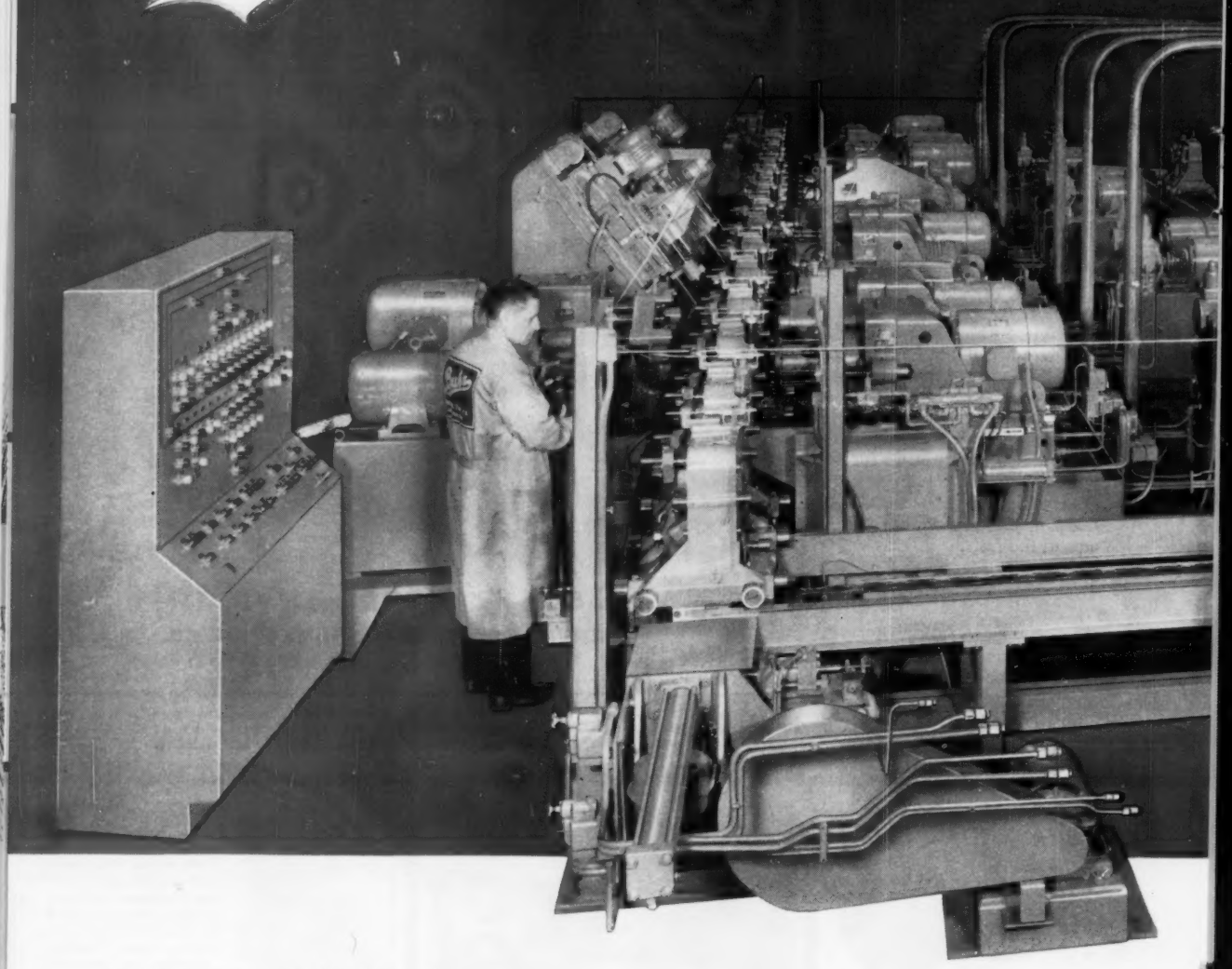


High volume coolant system on 30 Series machines assures an adequate supply of coolant to cutting tool. Table tee-slots are closed at the ends . . . table and saddle drilled allowing coolant to pass into a trough attached to bed of machine. Coolant tank is cast in the bed, or optional tank may be installed in floor.

Davis Super Micrometer Stub Boring Tools, available in complete sets, speed boring in production and tool room work. Line bars with block type or micrometer expansion tools also available.

Buhr ECONOMATIC

(15 STATIONS)



- Parts automatically clamped
- Automatic probing of tapped holes and deep holes
- Hydraulic back-up for heavy trepanning operations
- Automatic unloading of parts
- Exclusive Buhr Detector System in main console, signals and locates electrical failures instantly
- Fixtures washed on return to loading station
- Sectionalized bases to facilitate future part changes
- Automatic lubrication of all moving parts including fixtures
- All standard and special parts interchangeable for ease of maintenance
- Spindles arranged for pre-setting of cutting tools to minimize downtime for tool changes
- Hardened-and-ground steel ways
- J.I.C. Standards throughout

performs 55 operations every 23 seconds!

OPERATIONS...

21 drilling, 10 spotfacing,
3 rough and semi-finish trepanning, 2 reaming,
1 end-milling, 1 semi-finish bore,
1 finish bore, 7 tapping and 9 probing

PART . . .
automotive front
pump-body

CLOSE-UP OF AUTOMATIC
UNLOAD STATION

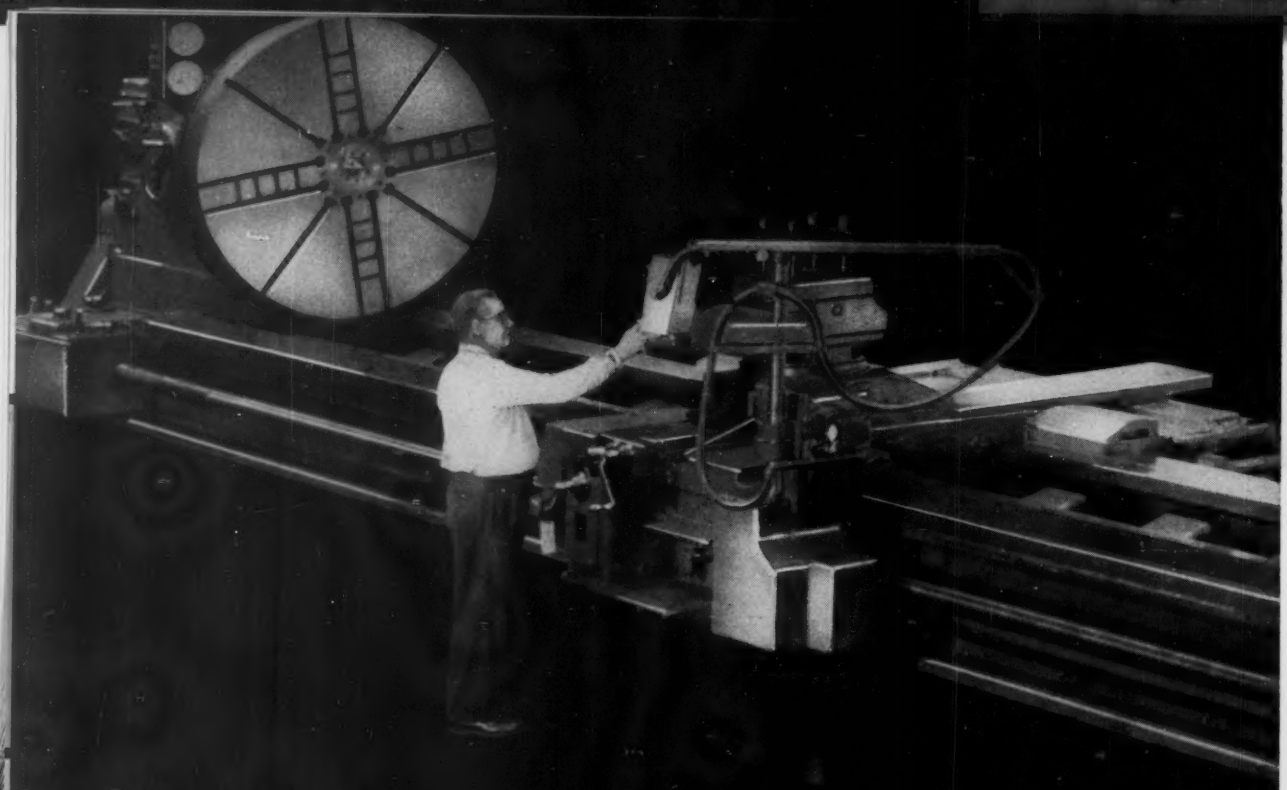
CLOSE-UP OF FIXTURE

Buhr
MULTIPLE-SPINDLE
HIGH PRODUCTION MACHINERY

BUHR MACHINE TOOL CO.

ANN ARBOR, MICHIGAN

Solidly Engineered • Precision Built • for World's Leading Manufacturers



NILES 72" Heavy-Duty Engine Lathe: Swing over bed and carriage wings is 73½" . . . over carriage bridge, 56". Main drive accommodates 150 hp., adjustable-speed, 4:1 DC motor (with variable voltage drive optional). Speed ranges—1.35 to 101 rpm or 2.2 to 151 rpm (optional).

Metalworking News from HAMILTON!

New NILES 72" Engine Lathe for faster set-ups,

Here's welcome metalworking news from Hamilton! An all-new 72" heavy duty engine lathe to boost your turning speeds and accuracy . . . for top machining quality at lowest cost. It's the Niles A72 Lathe with these exclusive bonus features:

Speed and load indicators on faceplate drive . . . for constant operator check on machine performance. Permits capacity loading with no danger of applying excessive overloads.

Adjustable, springloaded tailstock quill with load indicator . . . for accurate quill spring preloading to suit work piece. Cuts setup time and prevents damage to centers.

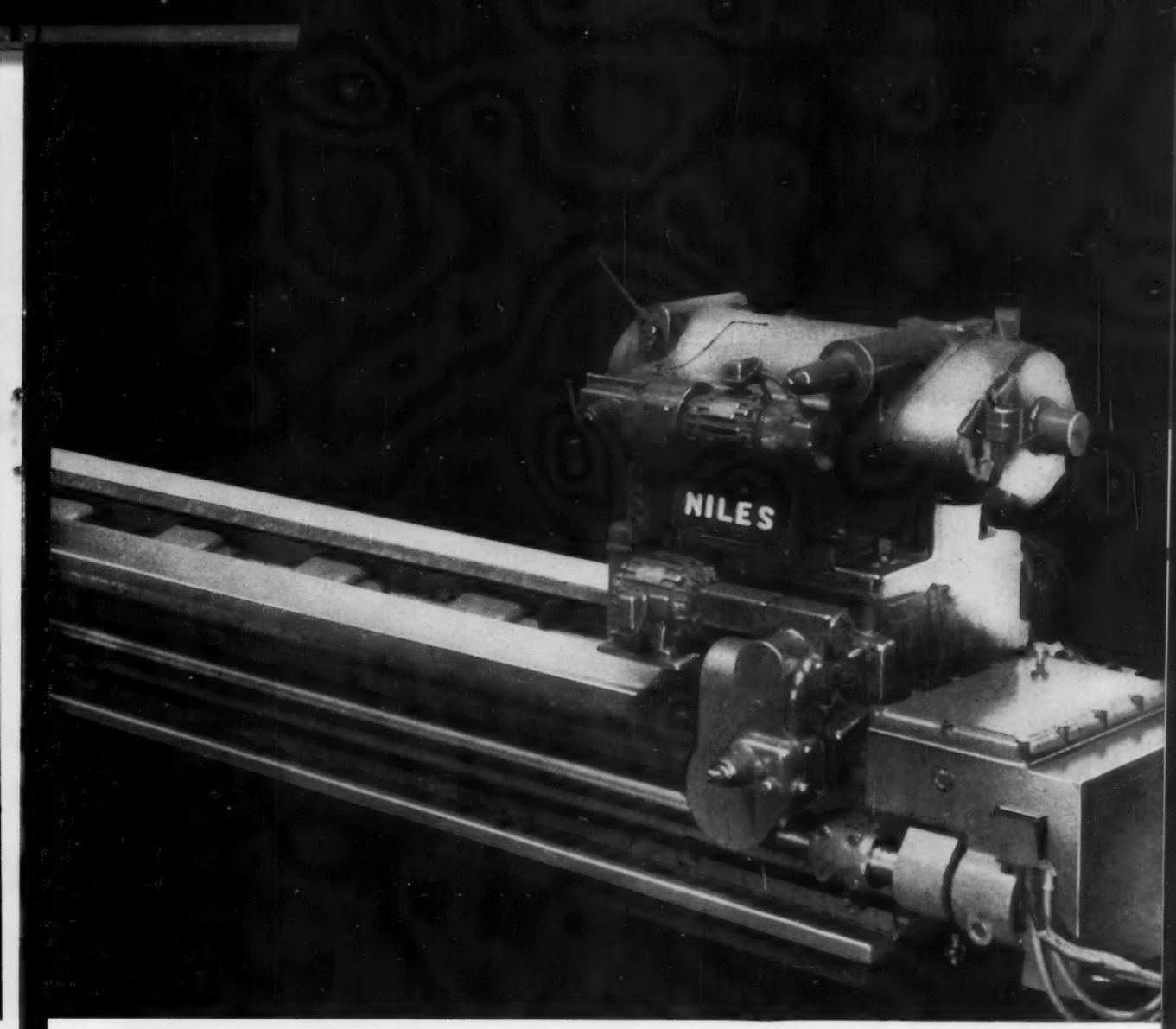
Fully enclosed leadscrew and thread selector dial . . . outmodes old-style tumbler gear selector. Eliminates opening where dust and dirt can enter to contaminate gear lubricant and foul machine operation. *Safer too!*

Hydraulic booster on faceplate speed changer . . . eliminates the heavy manual labor needed to change speeds on other large lathes.

Lubrication oil-pressure safeguard . . . prevents operating machine until positive lubrication is applied.

Optional electronic or mechanical feeds . . . with one lever selection and full pushbutton control at carriage station for either feed. Safety interlocks prevent simultaneous engagement of both. Number of feeds available: 64!

Put this new Niles A72 Lathe on *your* shop floor! You'll speed set-ups, cut machining time and slash operating costs on your heavy duty turning jobs. Easy, accurate controls make child's play of close tolerances. Get complete details on the all-new Niles A72 Lathe today. Send for new bulletin containing full specifications. Address: Dept. 9902, Hamilton Division, BLH Corporation, Hamilton, Ohio.



more accurate turning—at lowest operating cost

Look to HAMILTON for the engineering know-how, experience and facilities that mean outstanding performance *for you* from the full line of NILES Machine Tools:

NILES Heavy Engine Lathes—50″, 60″, 72″, 84″, 96″ and larger

NILES Vertical Boring and Turning Mills—12′, 14′, 16′, 30′ and 43′

NILES Railroad Tools—Hydraulic Centering Machine, End Drive Axle Lathe, Hydraulic Car Wheel Lathe, Hydraulic Diesel and Car Wheel Borers, Hydraulic Axle Burnishing Lathe

HAMILTON Mechanical Presses—single, double and triple action presses for metal forming and stamping; also open back inclinable presses, rail presses, welding presses and die fitting machines

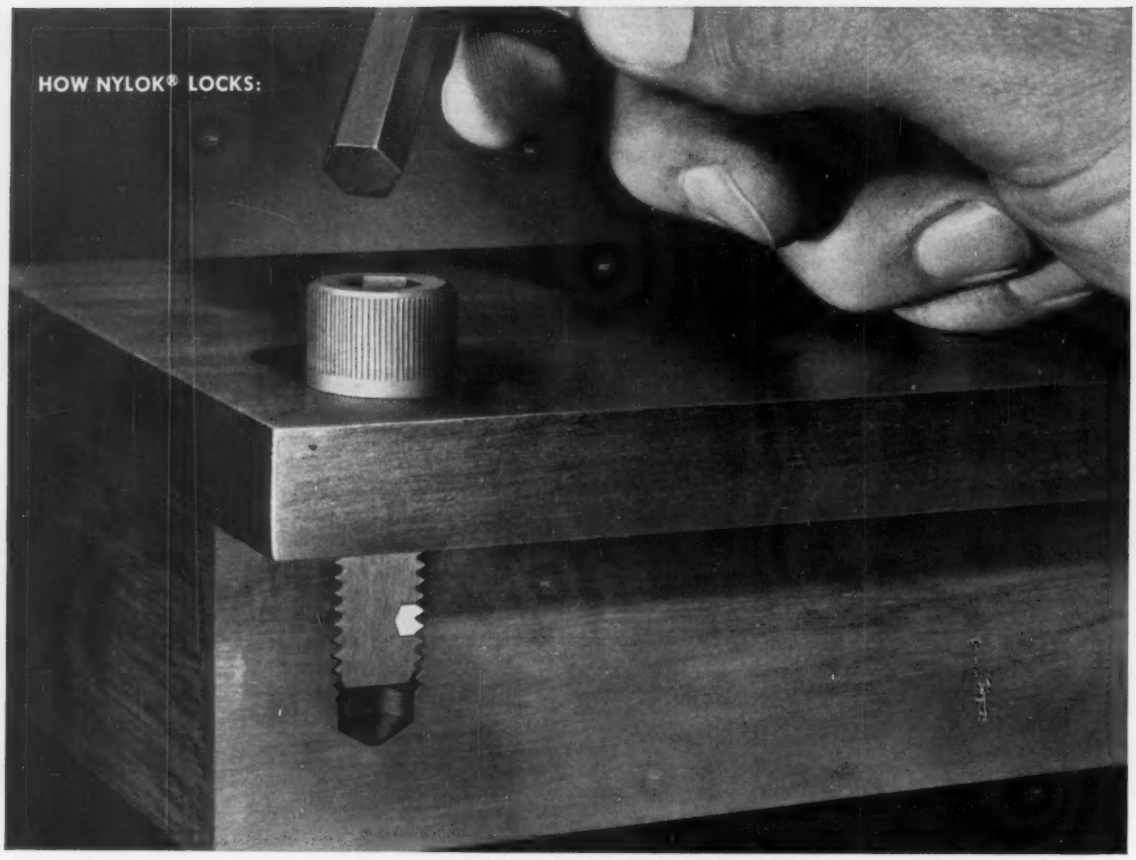
BALDWIN BLH LIMA-HAMILTON

HAMILTON DIVISION

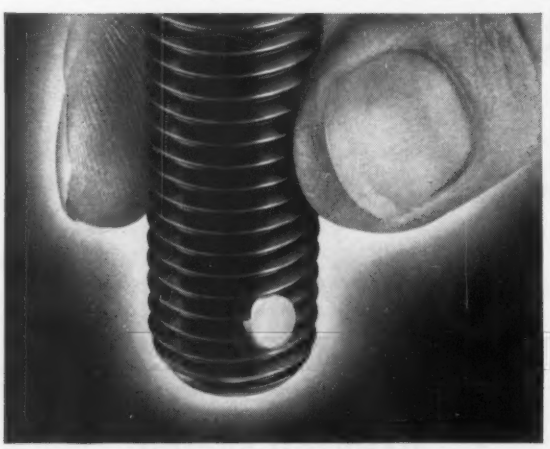
BALDWIN-LIMA-HAMILTON

DIVISIONS: Austin-Western • Eddystone • Hamilton • Electronics & Instrumentation • Lima • Madsen • Loewy-Hydropress • Pelton • Standard Steel Works

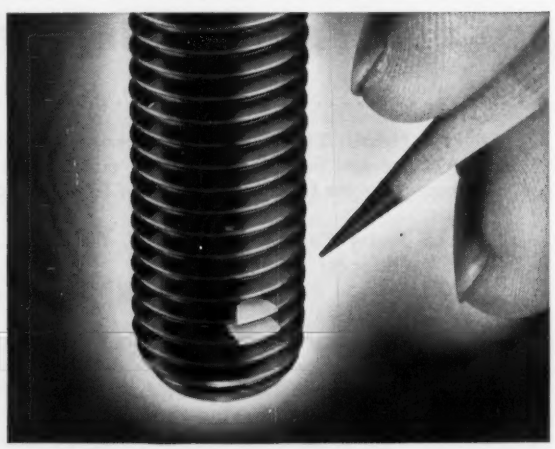
NEW—a complete line of socket screw products



LOCKED! The tough, resilient nylon pellet keys itself into the mating threads. It forces threads together, and locks the screw securely.



BEFORE ASSEMBLY. The nylon pellet projects slightly beyond male threads. When assembled, female threads will be impressed into it. Pellet locks effectively whether the screw is seated or not.



AFTER REMOVAL. "Plastic memory" of pellet has expanded impressed threads to greater diameter than screw threads. Screw can be used repeatedly. In use, "memory" keeps threads tightly locked.

self-locking UNBRAKO that won't work loose

They simplify design and save production time

UNBRAKO socket screws are now available embodying the Nylok* self-locking principle. Nylok provides a truly practical new solution to the problem of making screws self-locking.

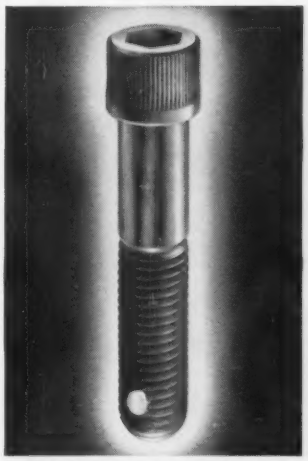
An UNBRAKO screw with Nylok is a single self-locking unit. No auxiliary locking devices are needed. Just thread the UNBRAKO into any tapped hole. *Seated or not*, it locks positively wherever wrenching stops. The tough, resilient nylon pellet forces mating threads together and holds tight. The screw will not shake loose.

You save production time when you build products with self-locking UNBRAKOS. And you get greater simplicity in design with less bulk and weight. The number of parts you must assemble to achieve full locking action is reduced to the absolute minimum. Lockwashers under screw heads are no longer necessary. Costly wiring of cross drilled heads is eliminated. So are cotter pins and complex multiple set screw installations.

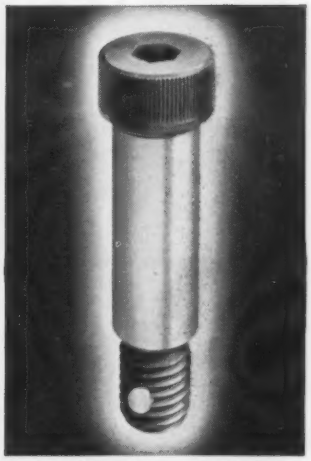
Self-locking UNBRAKOS are completely reusable. They have uniform locking and installation torques—with no galling or seizing on mating threads. They successfully withstand temperatures from —70° to 250°F. And, on properly seated screws, the pellet acts as a liquid seal.

Self-locking UNBRAKO socket screws come in a complete range of standard sizes and materials. See your authorized industrial distributor. Technical data and specifications are detailed in Bulletin 2193. Write us for your copy today. Unbrako Socket Screw Division, STANDARD PRESSED STEEL CO., Jenkintown 19, Pa.

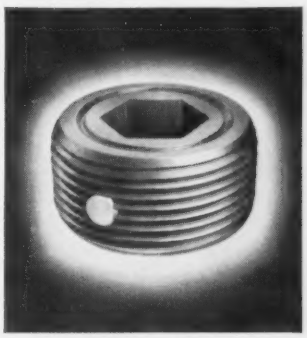
**T.M. Reg. U.S. Pat. Off., The Nylok Corporation*



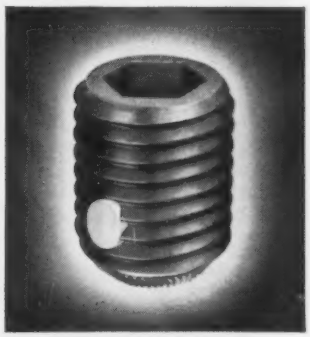
Socket head cap screws. Standard sizes # 6 to 1 in.



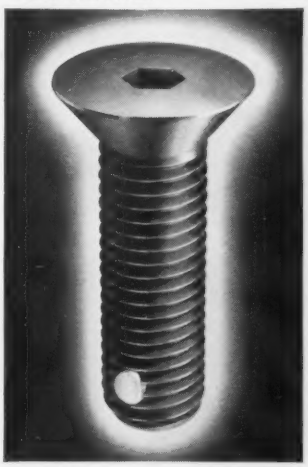
Socket shoulder screws. Standard sizes ¼ to ¾ in.



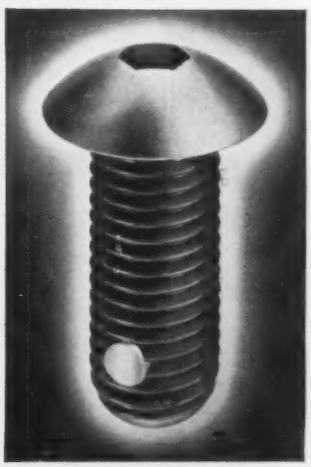
Socket pressure plugs. Standard sizes 1/16 to 1¼ in.



Socket set screws. All standard point types. Standard sizes # 6 to 1 in.



Flat head socket screws. Standard sizes # 6 to ¾ in.



Button head socket screws. Standard sizes # 6 to 5/8 in.

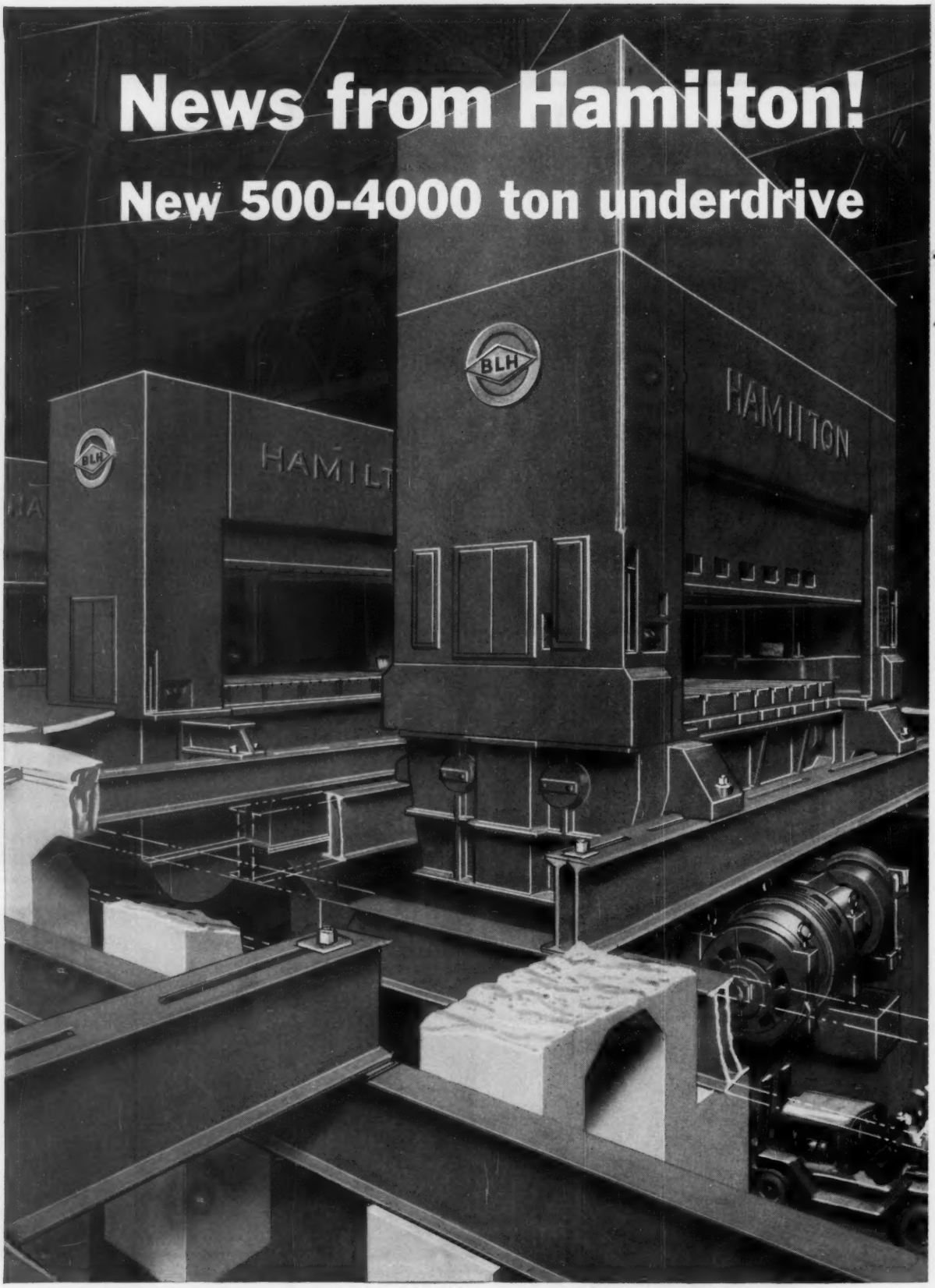
UNBRAKO SOCKET SCREW DIVISION

STANDARD PRESSED STEEL CO.

SPS

JENKINTOWN PENNSYLVANIA

For more information fill in page number on Inquiry Card, on page 241


News from Hamilton!
New 500-4000 ton underdrive
BLH
HAMILTON

draw press "package"...

• for fast easy installation...
• simplified maintenance...
• smooth, safe drawing...
• more productive strokes per minute

Thirty years the leader in the mechanical press field, Hamilton now gives you this latest product of dynamic press know-how. An all-new line of 500 to 4000 ton mechanical draw presses engineered for fast, safe drawing operation . . . with each press designed as a "package unit" for quick installation, simplified maintenance.

• *Package design* keeps all piping and wiring within the rugged, welded steel press structure. Installation is quick and easy . . . there's small chance of damage while installing. Once in place, the press unit can be put in operation simply by connecting piping and wiring to plant power services.

• *Hamilton's Exclusive Double-Lube system* provides both pressure and gravity flow lubrication to all bearings. Breakdowns from lubrication failure are virtually eliminated.

• *Operating mechanism in the press bed* simplifies inspection and maintenance . . . out of the way of production.

• *Variable cycle sequences* insure more productive strokes per minute. The press may have a fast advance and return, yet maintain a safe drawing speed.

• *Swivel arrangement of counterbalance cylinders* insures proper alignment when gibs are adjusted.

• *Safety die blocks and die lights* add effective operating safeguards.

You'll speed *your* production while you slash installation and operating costs . . . when you put these new Hamilton underdrive presses in your shop. They're designed and built to handle your toughest jobs better, faster—with far less downtime. Get the full story today! Write for complete specifications to Department 4519, Hamilton Division, BLH Corporation, Hamilton, Ohio.

Look to Hamilton for the press design and engineering leadership that guarantees peak performance from this quality line of dependable mechanical presses:

- Single acting, straight side single and double crank presses—100 to 300 tons
- Top drive, full eccentric presses—300 to 4,000 tons
- Underdrive draw presses—500 to 4,000 tons
- Double acting presses
- Triple acting presses

BALDWIN · BLH · LIMA-HAMILTON

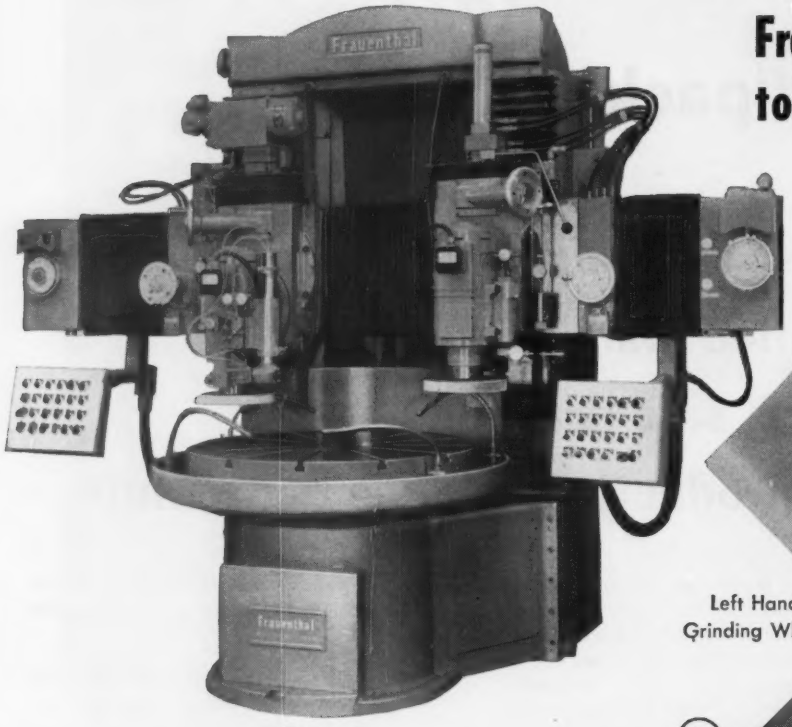
HAMILTON DIVISION
BALDWIN-LIMA-HAMILTON

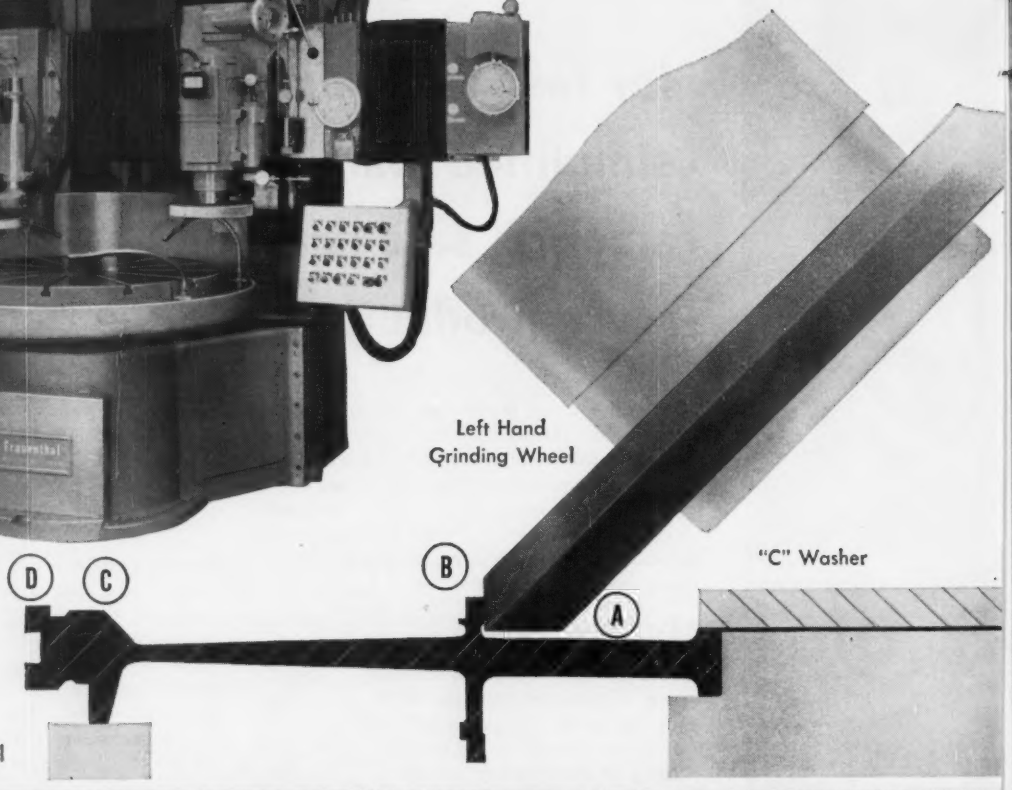
DIVISIONS: Austin-Western • Eddystone • Hamilton • Electronics & Instrumentation • Lima • Madsen • Loewy-Hydropress • Pelton • Standard Steel Works

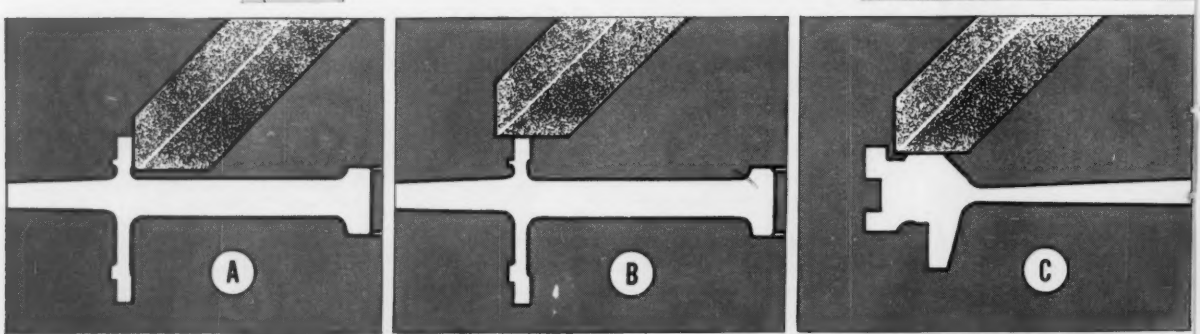
For more information fill in page number on Inquiry Card, on page 241

Multiple Grinding Operations

Frauenthal 1800 Series tolerances . . . assures







Jet engine part is set up on steel parallels and securely clamped to center pilot with large "C" washer.

Rigid mounting and proper alignment assures a high degree of accuracy in parallelism and roundness. Left hand grinding wheel grinds one diameter and three related surfaces to extremely close tolerances.

Frauenthal Division

in One Set-Up

Double Head machine finish grinds 6 surfaces to close concentricity of related surfaces...reduces grinding costs

As ILLUSTRATED in the schematic diagrams, three different diameters and three related surfaces of a jet engine component are precision-ground square and concentric with one another in a single setup using two grinding heads. This is a typical example of how a Frauenthal 1800 Series Double Head Grinder cuts grinding costs.

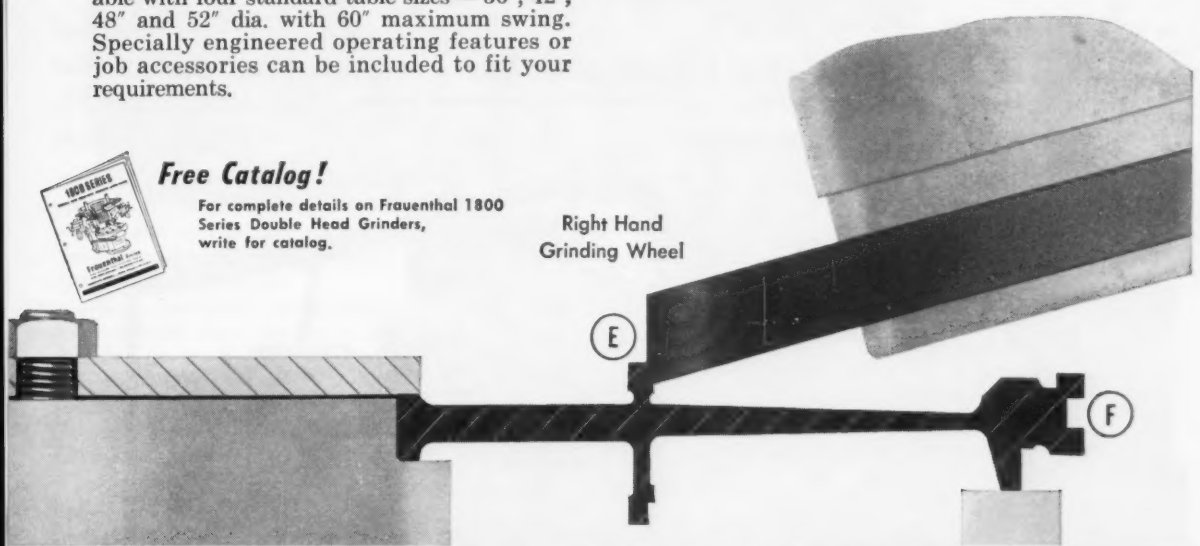
Frauenthal 1800 Series Grinders are available with four standard table sizes — 36″, 42″, 48″ and 52″ dia. with 60″ maximum swing. Specially engineered operating features or job accessories can be included to fit your requirements.

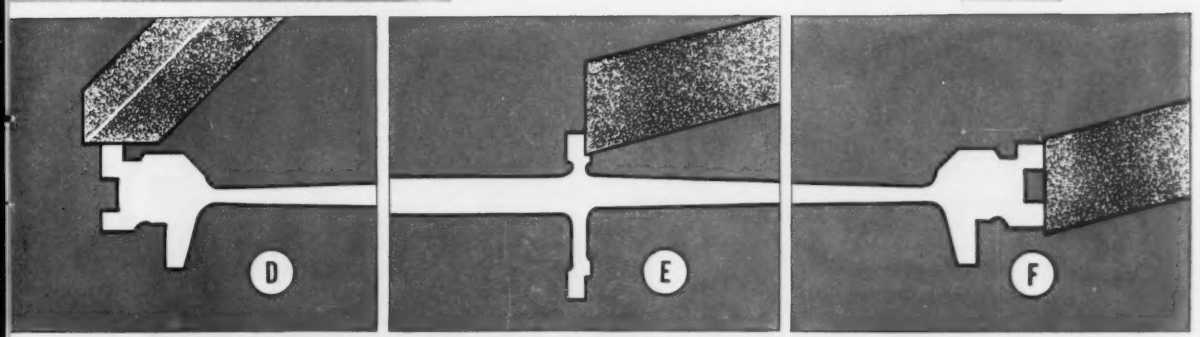
With Frauenthal Grinders (1800 Series or 2200 Series) you're able to grind a number of related surfaces (up to 140″ dia.) without changing setup of workpiece, and obtain accuracies within .000200″. This assures you *consistently* uniform precision in concentricity, parallelism and roundness.

For complete details, contact Frauenthal of Muskegon.

Free Catalog!

For complete details on Frauenthal 1800 Series Double Head Grinders, write for catalog.





Starting from center of workpiece it finish grinds INNER diameter "A", and TOP FACES "B", "C" and "D". Right hand grinding wheel finishes OUTER diameters "E" and "F". Both spindles are swiveled for accessibility to the workpiece surfaces. All surfaces of jet engine part are ground within .000200″.

THE KAYDON ENGINEERING CORP.

MUSKEGON, MICHIGAN

For more information fill in page number on Inquiry Card, on page 241

FOOTBURT

STATION TYPE MACHINES

PROGRESSIVE PRODUCTION...

With the Station Type Machine, Footburt continues to provide the most modern developments in production machinery.

Drilling, reaming, tapping, milling, checking and testing may be combined in one station type machine, and units may be mounted at any angle.

Installations of Footburt Station Type Machines have been made in many leading automotive plants, in some case handling the major machining on the block and head components.

THE FOOTE-BURT COMPANY • Cleveland 8, Ohio

Detroit Office: General Motors Building

19 Station — 115 Spindle
Drilling and Milling Machine

engineered for production

FOOTBURT

MACHINE TOOLS

For more information fill in page number on Inquiry Card, on page 241

Production Pointers from GISHOLT

MASTERLINE GISHOLT SINCE 1887

TIME-SAVING IDEAS

Presented as a service to production men, we hope some of these interesting ideas, chosen from thousands of jobs, will suggest ways to help cut time and costs in your own work.

HOW SMART PRODUCER SOLVES TRICKY MACHINING PROBLEM

Saddle Type Turret Lathe with 4-Way Fixture and JETracer on Octagon Turret Makes Complex Job Easy

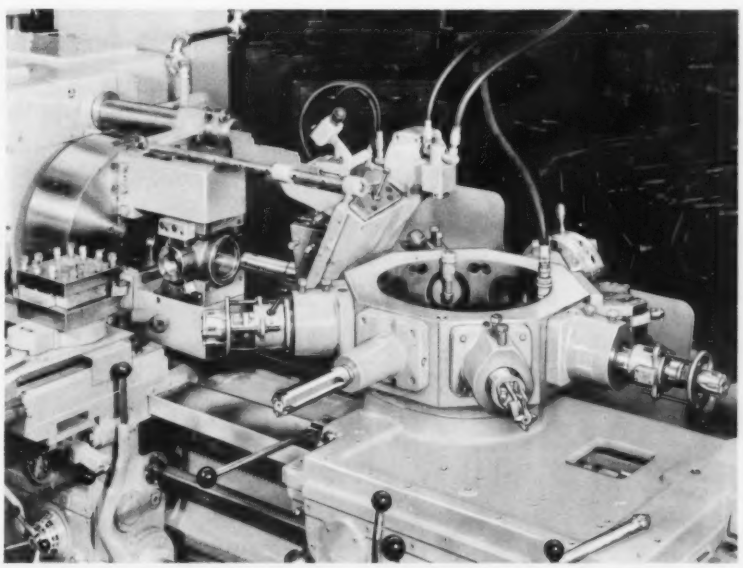
Here, the producer solved a complex problem by carefully planning his tooling and by selecting a machine designed and equipped for most efficient handling of the job.

The objective was to completely machine steel valve bodies in one chucking for maximum accuracy. By using a Gisholt MASTERLINE 3L Saddle Type Turret Lathe with special features, the producer greatly simplified the entire operation.

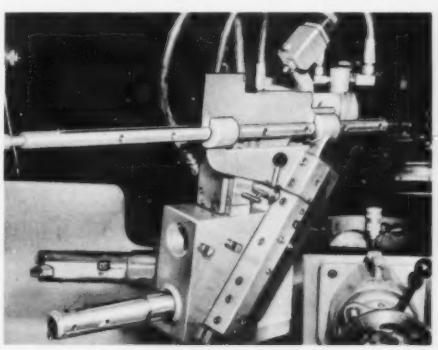
Loading and unloading are made quick and easy with a built-in power hoist. The workpiece is held in a special four-position indexing fixture, carried in a 24-inch two-jaw air chuck. Maximum accuracy is assured by completing all surfaces in a single chucking. An eight-sided octagon turret, mounting a Gisholt JETracer on one turret face, plus seven other fully tooled turret stations and a fully tooled square turret are used to complete the job. A full-length lead screw and selective gear box are used for accurate threading. A 50 h.p. single-speed motor assures smooth, dependable operation with ample power when needed.

Here is the machining sequence: Locate and chuck in fixture. Machine all surfaces on End A. Index fixture. Machine all surfaces on End B. Index. Machine End C. Index. Machine End D. Index back to starting point. Contour-bore A in one pass with turret-mounted JETracer and tap to complete the part. Floor-to-floor time is approximately 25 minutes for the 2-inch screwed-end type valve body.

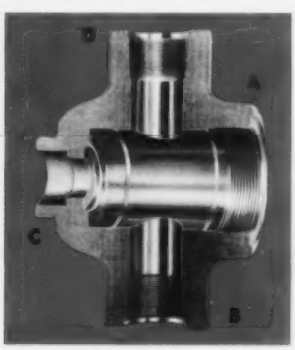
All surfaces are machined in a single chucking, using Gisholt 3L with JETracer and special indexing fixture. JETracer does not impede normal operation and offers maximum accuracy with minimum attention from the operator.



Close-up of tooling. Note eight-sided octagon turret, with JETracer facing workpiece.



Close-up of JETracer, which finishes all bores, counterbores, steps and faces from End A.



The workpiece—a 2-inch screwed-end type steel valve body—showing machining operations performed.

MASTERLINE GISHOLT SINCE 1887

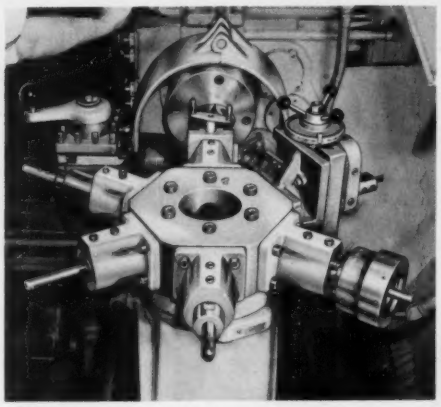
TIME-SAVING IDEAS

ACCURATE TAPER GENERATED WITH THIS SETUP

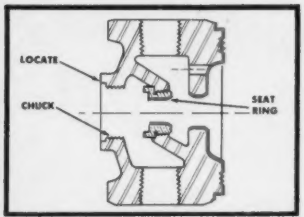
Special Boring Tool on Ram Type Turret Lathe Speeds Valve Body Output

Good headwork by this producer is saving both time and money on production of steel relief valve bodies—using a Gisholt Ram Type Universal Turret Lathe.

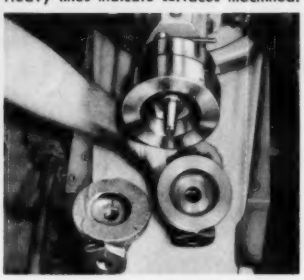
The workpieces have been previously machined and threaded in the I.D., and the seat ring has been inserted. Each part is screwed onto a special threaded fixture locating against the previously machined face. The flange and seat ring bores are machined simultaneously from the hexagon turret. Other hex turret tools ream and size both bores, finish the taper on the seat ring, and chamfer the back and front of the flange bore. Tools on the square turret turn the O.D. part way, then face, groove and form the flange face.



Overhead view of tooling, showing chamfering operation being performed in flange bore.



Heavy lines indicate surfaces machined.

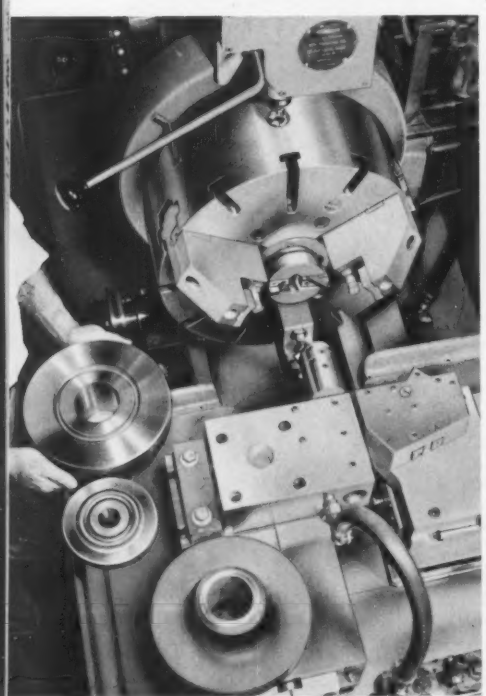


Close-up showing special taper tool, with finished workpiece below in operator's hand and rough part at left.

Of particular interest is the special taper tool, which machines the taper on the seat ring. A stop collar engages its outer face with the flange face on the workpiece, and rotates with the work. Then the boring bar—extending from the center of the tool—is cammed by continued forward movement of the turret ram, generating the precise angle desired on the seat ring.

Machining operations are simplified on this job with minimum special tooling. Floor-to-floor time is just 8.5 minutes.

BEATS HIGH COSTS ON MACHINING PARTS IN 13 SIZES



Simplimatic with Back-Facing Attachment and Two-Speed Motor Handles Each Part in Single Chucking

There's more to this job than meets the eye. Not only are two different types of parts machined, but each type comes in 13 different sizes! The workpieces—steel welding neck flanges and welding necks—are used to join high-pressure piping.

Here's how a Gisholt Simplimatic Automatic Lathe completes each part in a single chucking and holds changeover time to an absolute minimum.

Facing, grooving, boring and chamfering operations are performed from tools on short tool slides, with T-slotted tops for quick adjustment. The boring tool is relieved at the end of the cut to eliminate tool tracks. At the same time, a special back-facing attachment works through the spindle to shave-face and chamfer the O.D. on the hub. A power chuck wrench operates the scroll chuck, and permits mounting the back-facing attachment in the spindle bore. Correct surface speed in f.p.m. is provided by a two-speed motor, equipped to switch from high speed (for turning and facing) to low speed (for grooving operation) and back again, during the Simplimatic's automatic machining cycle.

Good planning on Simplimatic holds f.t.f. time on smallest 6½" diameter workpieces to only 1.7 minutes, on largest 10¾" diameter workpieces to just 3.3 minutes.

Close-up shows machined front side of large workpiece (in operator's hands) and of small workpiece...machined back side of large workpiece in foreground...power-chuck wrench...and back-facing attachment protruding through spindle bore.

GISHOLT

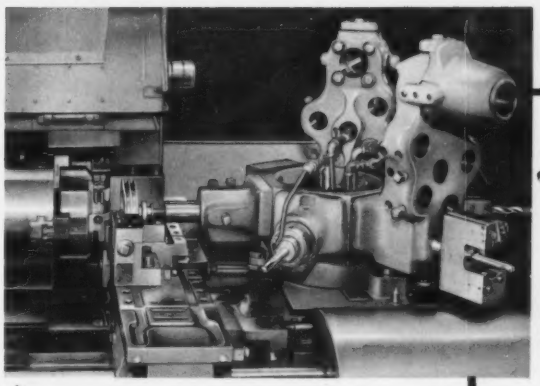
TIME-SAVING IDEAS

400% INCREASE IN PRODUCTION WITH THIS SETUP

Well-Planned Casting Design Plus Good Setup on Fastermatic Quadruples Unit Output

Here's how Albertson & Company, Inc., of Sioux City, Iowa, has put production of small, cast iron sheaves on a high-speed, high-production basis with a Gisholt 1F Fastermatic Automatic Turret Lathe. Tooling costs are held to a minimum, but where necessary, multiple cuts are taken to assure maximum accuracy.

To exploit the full potential of the versatile Fastermatic, Albertson designed the workpiece with a special chucking ring as part of the original casting. A standard three-jaw air chuck holds the part on this ring throughout the machining operations. Hexagon turret tools turn all outside diameters, complete the bore and shave-face the small hub. Special form tools on the front cross slide form grooves on small hub. Similar form tools on the rear cross slide form V-belt grooves on large sheave O.D., after which a parting tool cuts the piece off the chucking ring. Simultaneously, a special catcher on Station No. 5 slips in the bore to receive the part. The hexagon turret indexes to the next station and the cycle stops. The operator unchucks the chucking ring—inserts a new workpiece—and removes the finished sheave from the catcher, to inspect it while the new part is being machined.



▲ Workpiece shown after cut-off. Special turret-mounted catcher holds completed part.

Top to bottom: casting with chucking ring on; chucking ring after cut-off; finished workpiece. ▶

Smart setup on this Gisholt Fastermatic jumped production on this job from 24 pieces to 100 pieces per eight-hour shift—shortening floor-to-floor time to only 4.5 minutes.

"HOT BOX" TROUBLES REDUCED BY SUPERFINISH

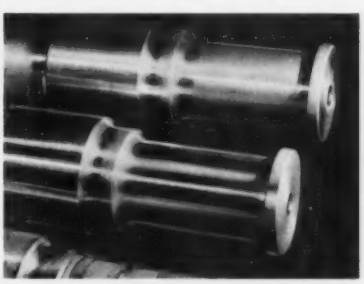
Simple Attachment Reduces Costs, Increases Service Life

▲ "Test" axles being Superfinished on Gisholt Saddle Type Turret Lathe equipped with No. 4 Superfinishing Attachment on the side carriage.

The "hot box"—as applied to journal and plain bearings—is one of the most critical situations faced by the railroads today. Davenport Besler Corporation investigated the Superfinishing process and had a complete set of axles Superfinished and installed on a switcher for testing. After four months of service, no trouble was reported.

Davenport Besler then installed a Gisholt No. 4 Superfinishing Attachment on an engine lathe in its own shop. The journals are turned to an average lathe finish of 200-250 micro-inches rms. After a three-step—rough, semi-finish and finish—Superfinishing operation, a final surface finish of 8-10 micro-inches rms is obtained. The floor-to-floor time varies from 15 to 30 minutes because in some cases, .004" to .005" stock has to be removed to eliminate all toolmarks.

Over 25 switchers were put in service with all axle journals Superfinished. During the first few months, some 30,000 hours of trouble-free operation were recorded, proof-positive that Superfinish really pays off!



Before and after Superfinishing. Top journal after turning...lower journal has been Superfinished to 8-10 micro-inches rms. ▶

Superfinishing from a turned surface saves considerable production time. Because amorphous or smear metal is removed and the true base metal exposed, it is no longer necessary to harden the work surface—an added saving through the modern Superfinishing process.

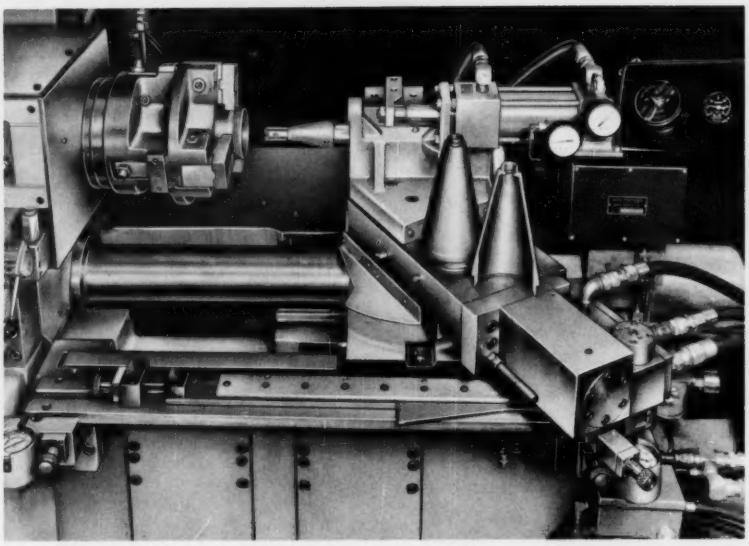
GISHOLT

MASTERLINE GISHOLT SINCE 1887

TIME-SAVING IDEAS

AN EXCELLENT WAY TO HANDLE TAPER BORING OPERATIONS

No. 12 Automatic with JETracer, Variable Speed Drive and Special Fixture, Whips Problem Part



Special chucking fixture shown at left. Boring bar and tool-relief arrangement shown at right rear. Finished workpiece and cut-away section, on front of JETracer slide, show surfaces machined.

This manufacturer wanted to cut costs, increase production and improve the finish in taper boring operations on shell noses. He's doing it with a Gisholt MASTERLINE No. 12 Automatic Production Lathe, equipped with a JETracer in place of the usual front carriage.

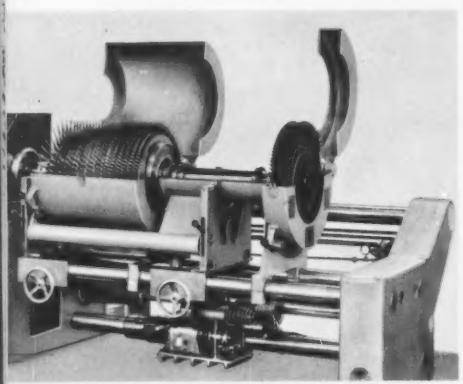
The workpiece tapers on the O.D. from four inches to 1⅜ inches. It is chucked without distortion by a special air-operated three-jaw chucking fixture, with the jaws gripping on the large O.D. Accurate longitudinal location is obtained through an adjustable work-centering cone in the spindle.

The problem of maintaining a 125 micro inch finish for the entire tapered length of cut is solved by a variable speed drive arrangement, controlled by longitudinal motion of the JETracer slide carriage. The JETracer slide traverses to the workpiece and changes to feed for the boring operation. At the end of the cut the boring bar retracts, providing tool relief, and the slide returns to starting position.

Smart chucking arrangement—plus Gisholt JETracer on No. 12—permits completing I.D. on this job in only .77 minute floor-to-floor time.

HIGH-SPEED LIFE INSURANCE THROUGH ASSEMBLY BALANCING

Eliminates Unbalance Caused by Cumulative Tolerances of Component Parts



Gisholt DYNETRIC 3UJP Balancing Machine, showing balancing of jet engine rotor assembly. For consultation with engineering specialists on vibration or balancing problems, write Gisholt.

One of the reasons why today's jet pilots can fly with greater safety—at faster speeds and higher altitudes—is modern assembly balancing of their engines.

Here is a typical example. This Gisholt DYNETRIC 3UJP Balancing Machine is used to balance jet engine rotor assemblies, consisting of a turbine shaft, two turbine wheels, and a compressor which has been balanced before assembly. The entire rotor assembly is dynamically balanced to a tolerance of .50 ounce inches in the right plane, with correction made by removing stock from a balance-ring machined on the outside face of the second turbine wheel—and to a tolerance of .75 ounce inches in the left plane, with correction made by adding weight on the flange at the junction of the compressor and the turbine shaft. After balancing, the parts are match-marked and are then disassembled.

Assembly balancing permits balancing ultimate assembly as a unit, providing smoother-running, longer-lasting modern jet engines.

DYNETRIC BALANCERS GISHOLT

DEVELOPED JOINTLY WITH WESTINGHOUSE ELECTRIC CORPORATION. "DYNETRIC" IS A TRADE MARK REG. U. S. PAT. OFFICE BY WESTINGHOUSE ELECTRIC CORPORATION

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THE GISHOLT ROUND TABLE represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

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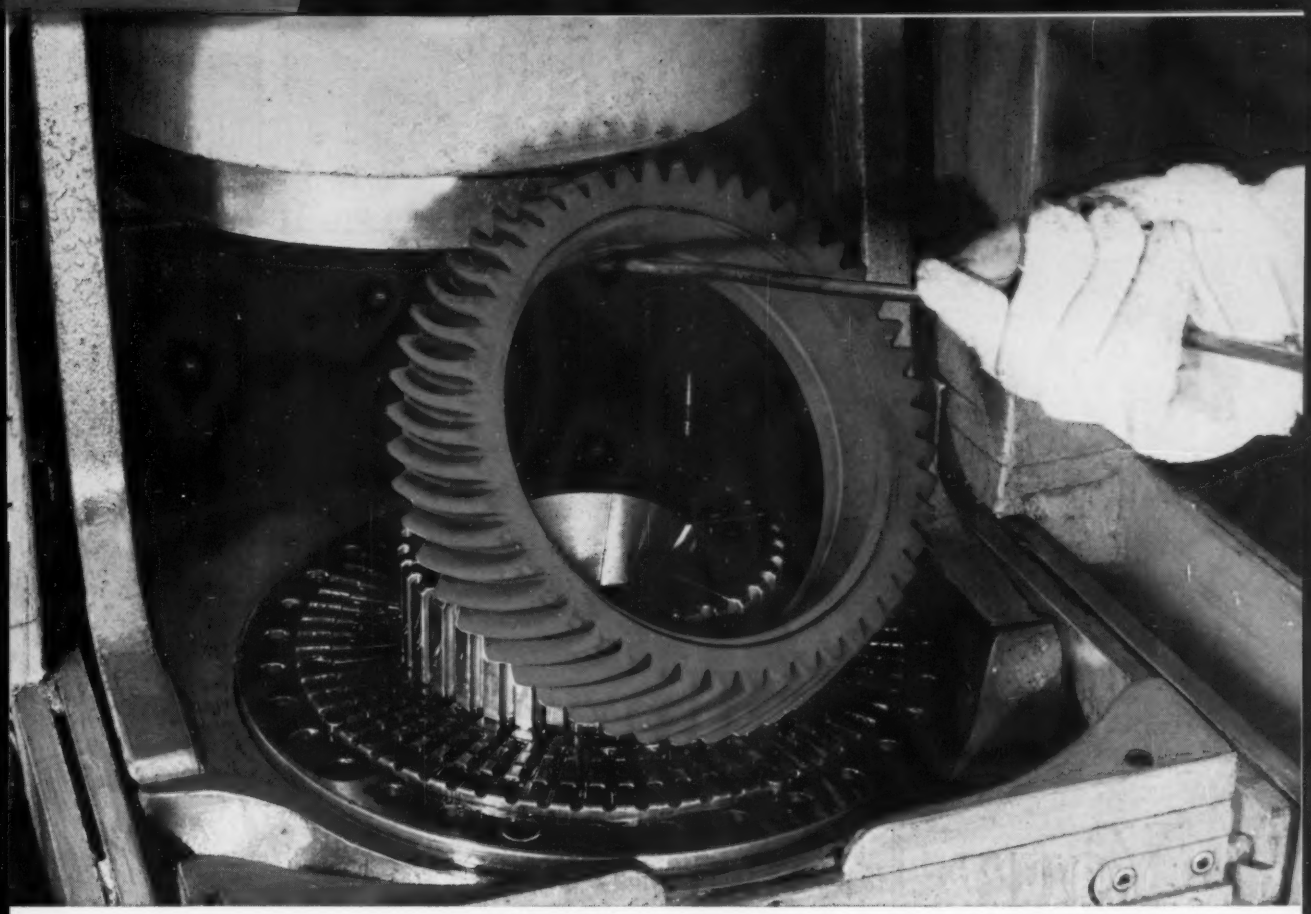


How to hold close tolerances when you quench gears and other parts

If you make parts like this aircraft transmission gear, you know that warpage or distortion during quenching means losing the time and money you've spent machining the part to close dimensional tolerances.

You can avoid such costly losses with Gleason Quenching Equipment.

The hot gear above, for example, is being set on the lower die of a Gleason Quenching Press. A button is pressed and the automatic quenching cycle is started. The lower die is swung back into the quenching position and the upper die descends rapidly, aligning the part while it is still in the plastic state.

The dies securely clamp the gear, but are so designed to permit it to contract in the normal manner, while still holding the gear true.

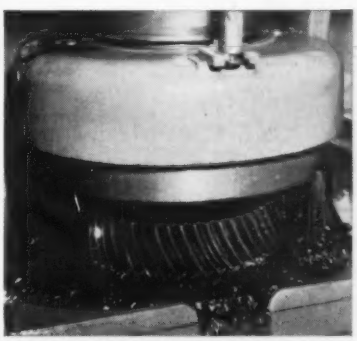
Carefully controlled, metallurgically correct oil circulation hardens the gear to perfection.

Post-quench tests show the gear meets all specifications.

You can give *any* part, regardless of shape, the same distortion-free quenching.

Three sizes of the Gleason Quenching Press harden parts up to 36″ diameter. Another press automatically hardens and straightens shafts and shaft parts up to 40″ in length.

For literature and recommendations on the press and die equipment that fit your products, send us blueprints.



The Gleason Quenching Press forces oil uniformly over and around the part, assuring the correct hardness and distortion-free quenching.

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For years Mobil D.T.E. oils have set the standard of quality for all hydraulic and circulating oils. Recently they were dramatically improved—so much so that their margin of superiority is now greatly increased.

New Mobil D.T.E. oils are *balanced* to meet the widest range of operating conditions. They will give years of trouble-free service—even in continuous high temperature circulating systems. They will keep your machines free from deposits over the complete range of service. They will give you the highest degree of protection against wear...rust...corrosion. In fact, tests show *most machines will become obsolete before these oils need changing* when operating at normal temperatures.

Let us show you concrete *proof* that new balanced Mobil D.T.E. oils can improve production and cut manufacturing costs. Ask your Mobil representative for the "balanced" story.

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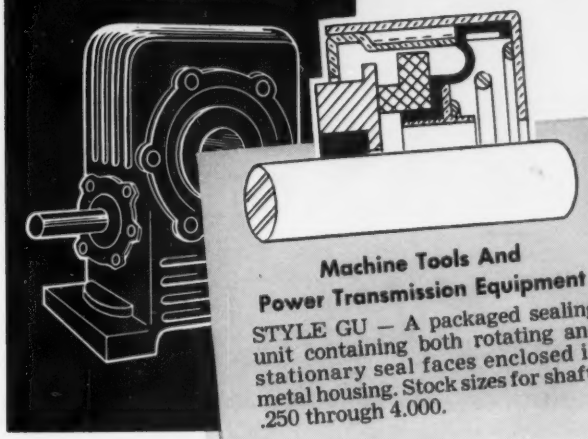
FIRST STEP IN CUTTING COSTS

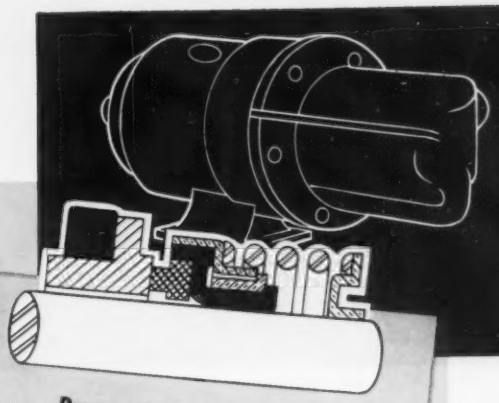
SOCONY MOBIL OIL COMPANY, INC., and Affiliates: MAGNOLIA PETROLEUM COMPANY, GENERAL PETROLEUM CORPORATION

For more information fill in page number on Inquiry Card, on page 241



Machine Tools And Power Transmission Equipment

STYLE GU — A packaged sealing unit containing both rotating and stationary seal faces enclosed in metal housing. Stock sizes for shafts .250 through 4.000.



Pumps And Compressors

ROTO-FLEX — Rugged flexibility. Only 3 parts. Single or double units. Stock sizes for shafts .250 through 4.000.

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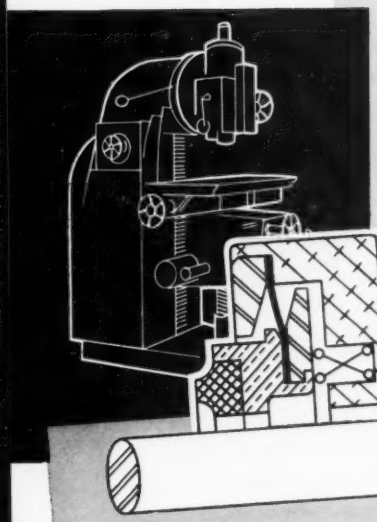

Heavy Machine Tools

STYLE DPC — A high-speed, carbon-faced seal, for more compact installation in heavy industrial machinery. Stock sizes for shafts .250 through 4.000.

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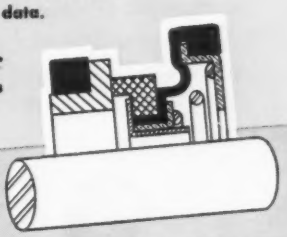
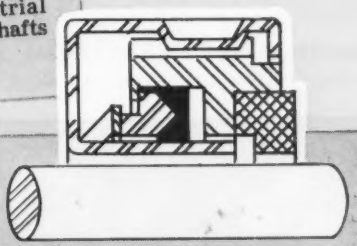


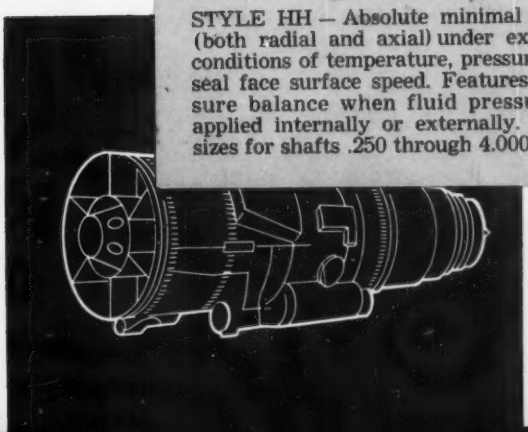
Household Appliances

STYLE SGU—A factory-assembled unit-type seal for the small-budget user. Stock sizes for shafts .250 through 1.000.

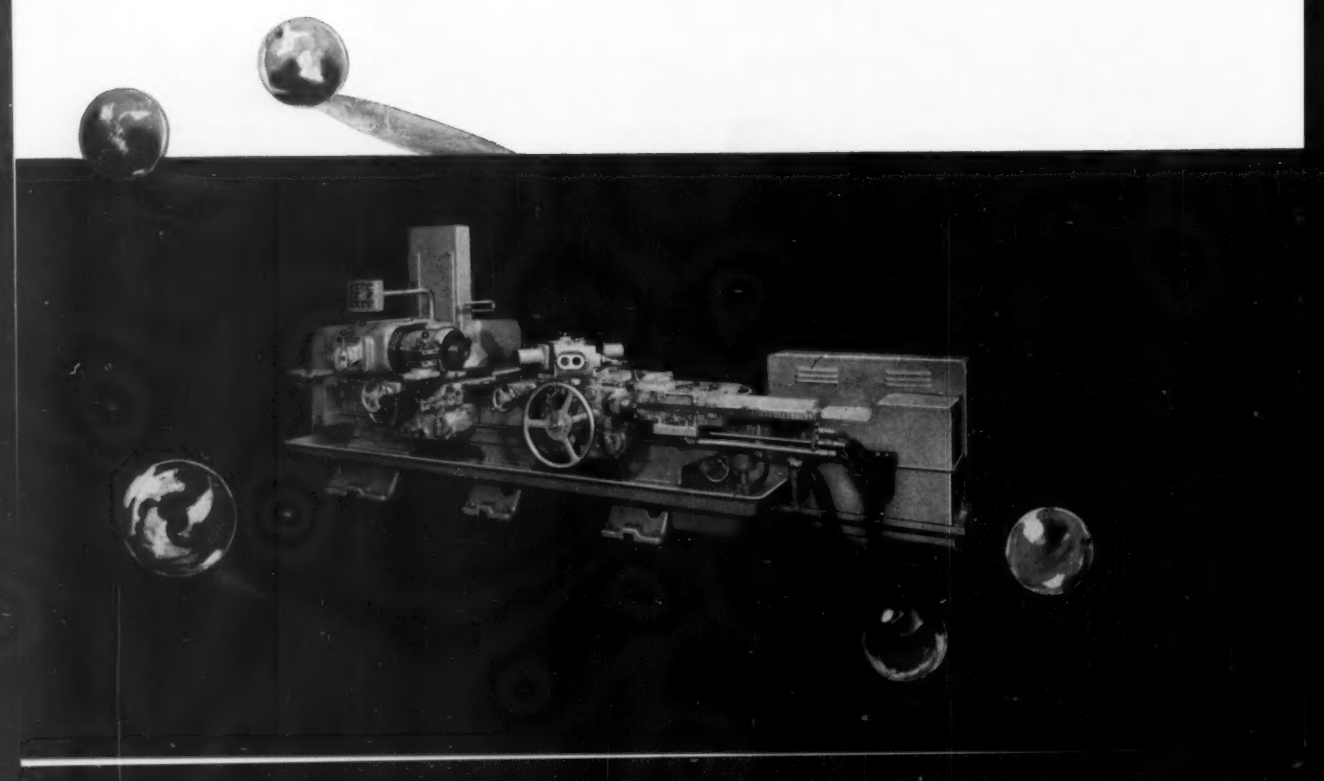


Aircraft Engines And Accessories

STYLE HH — Absolute minimal space (both radial and axial) under extreme conditions of temperature, pressure and seal face surface speed. Features pressure balance when fluid pressure is applied internally or externally. Stock sizes for shafts .250 through 4.000.



CHILD'S PLAY



Speed is not enough! To pay for itself out of reduced operating costs and increased profits, today's machine tool must be:

1. Easy to understand. 2. Child's play to operate.

3. Quick to convert in change-over and re-tooling.

4. Push-button simple to demonstrate in operator training.

Here are a few of the many advanced engineering features which have made today's Jones & Lamson machine tools the most flexible and cost-efficient metal cutting equipment in the industrial world today.

Two-way tracing combined with normal turret lathe operation; Hydra-clutch headstock and Geneva saddle for simple "on the machine" handling; Automatic handling, gaging, chip disposal, sorting, tool adjustment on single spindle automatics; Tape controlled turret lathes for flexibility on long or short run jobs with pre-set tooling, no hand controls; Thread and form grinders with fully automatic handling and machining cycles; Contour grinders controlled hydraulically or optically, and "Automatic thread chasing on standard turret lathes".

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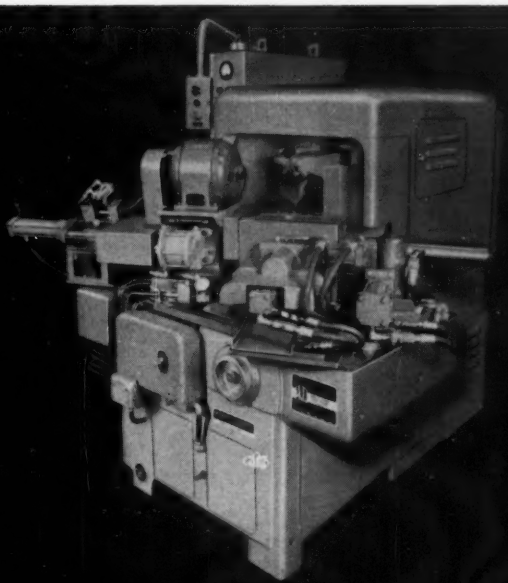
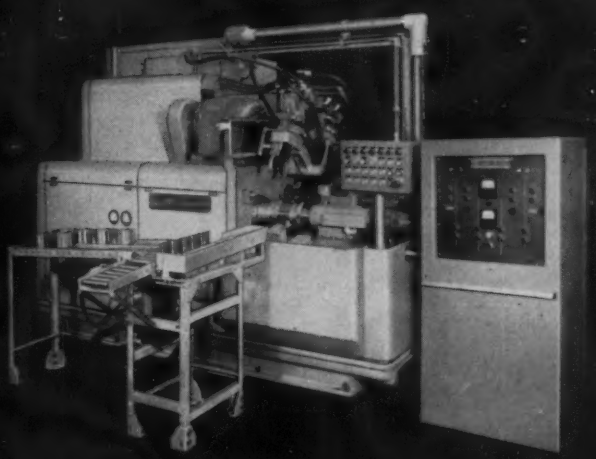
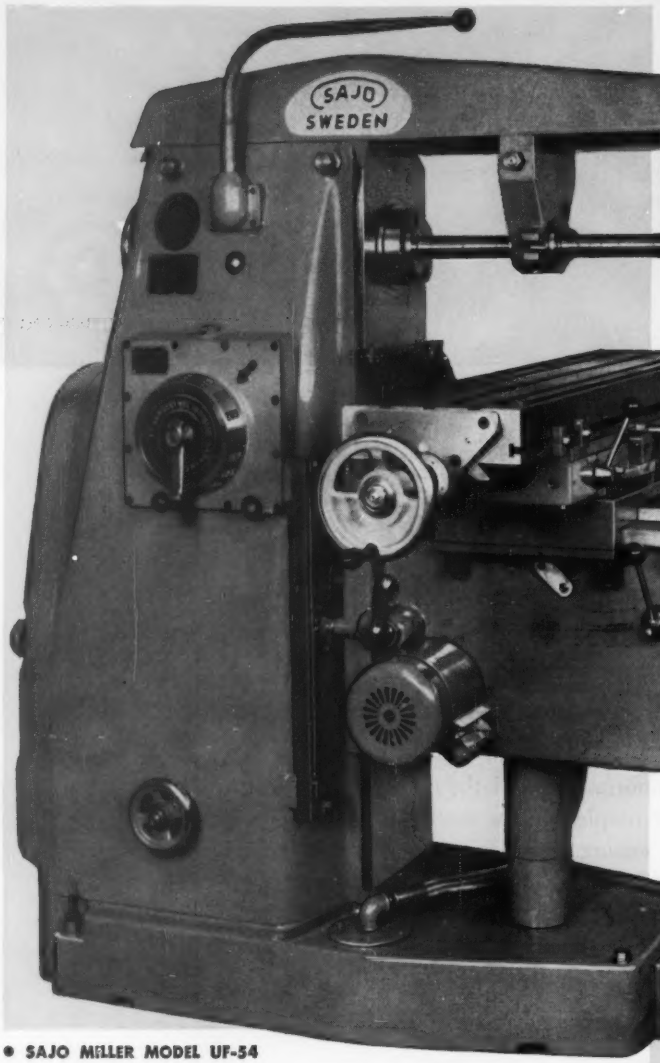
Turret Lathes *Fay Automatic Lathes* *Milling & Centering Machines* *Thread & Form Grinders* *Optical Comparators* *Threading Dies & Chasers*







• SAJO MILLER MODEL UF-54

FÖRBÄTTRAR DET BÄSTA

[IMPROVING THE BEST]

High quality standards change only to become more exacting. The SAJO Milling Machines exemplify modern precision perfection in Swedish craftsmanship.

SAJO builds for accuracy to tenths and dependability that assures profitable production. Built to U.S. Standards, initial cost and maintenance are considerably less than comparable first quality millers.

The SAJO Model 54 is a full No. 2 capacity ALL-GEARED Miller in Plain or Universal types with handscraped sliding surfaces, and SKF Special Precision bearings on spindle and gear shafts.

POWER

7½ HP motor for spindle (5 HP optional). 1½ HP motor for table feed and 3 direction rapid traverse.

RANGE

16 spindle speeds 39-1500 RPM (31-1200 optional), No. 50NMT spindle, 12 table feeds 11/16 to 25 inches/min. longitudinal and cross, 11/32 to 12½inches/min. vertical. Power rapid traverse, all directions. Table travel 33½" long., 10" cross, 18" vertical.

CONTROLS

Single adjustable START-STOP-BRAKE lever. Dial selection of speeds and feeds (U.S. inch calibrated) with single lever controls. Magnetic motor starter.

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A consistent electronic ear in the Red Ring Gear Speeder has replaced the human sense of hearing which, as we know, varies with the fatigue and mental attitude of the listener.

This electronic sound discriminator is readily adjusted to reject gears at any point within the range of audible noise frequency and intensity.

The Model GSR Speeder for gears and pinions in the smaller sizes is fully automatic. Gears are loaded, run in both directions, with and without a brake load and are either passed or rejected by the electronic sound discriminator as a continuous operation. ***Write for Details.***

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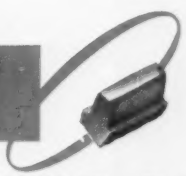
ORIGINATORS OF ROTARY SHAVING
AND ELLIPTOID TOOTH FORM

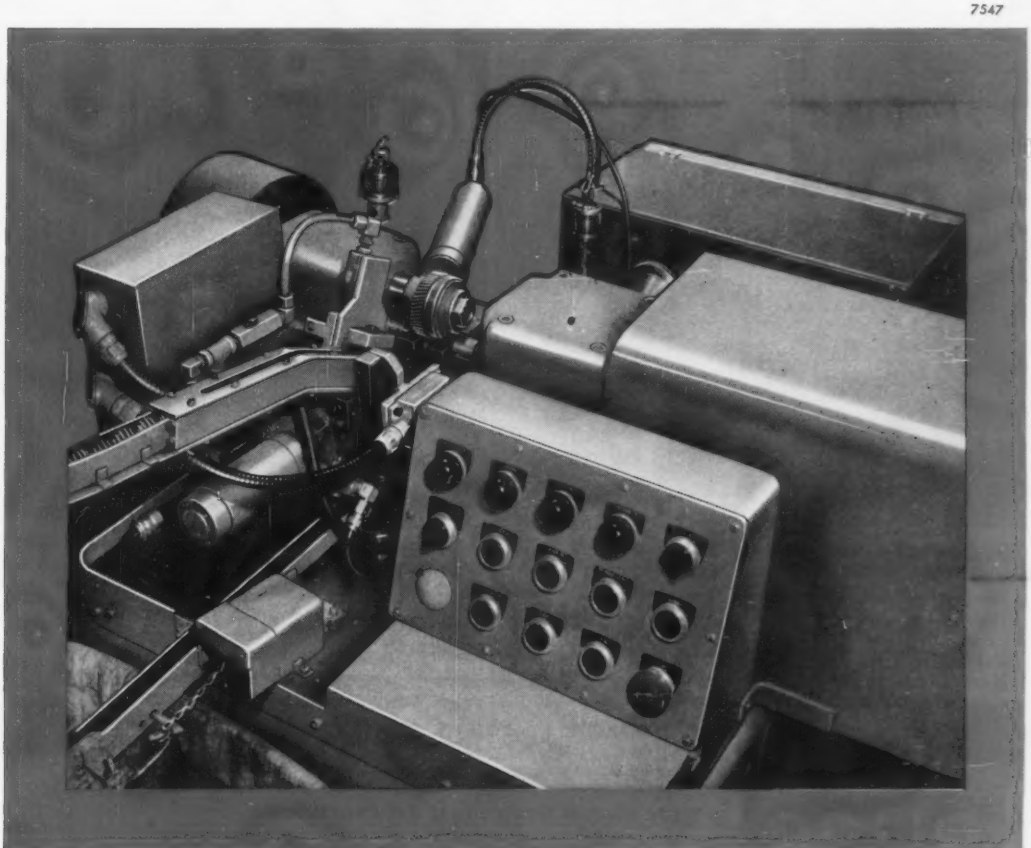


NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN • DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

7547



Two of America's Most Modern

22 BLISS HYDRO-DYNAMIC PRESSES WORK FOR BOTH ARMY AND NAVY AT EKCO PRODUCTS

At Ekco Products Company, Chicago, one line of Bliss presses ranging from 75 to 2500 tons produces 76 mm cartridge cases... and another line of eleven makes 3"/50 Navy cases.

The speed at which the lines are operated is "classified" information, but you may be sure it is exceptionally fast. As a matter of fact, their performance so exceeded their original "specs" that the lines have become known throughout the ordnance world.

Press operations on both lines are the same—a series of eleven steps beginning with pre-cupping a steel blank, then cup, four draws, pre-head, final draw, heading, and two tapering operations. Only difference between the Army and the Navy lines is a slight variance in tapering techniques.

Designing and building entire ordnance lines, both hydraulic and mechanical, has been a specialty of Bliss since Spanish-American War days. Today, Bliss press lines are as common throughout ordnance as they are throughout industry at large.

If you have a pressed metal problem, put this experience to work—let Bliss help you pick the one right press—or press line—for the job.

PRE-CUPPING—Army and Navy case production on each line begins with a Bliss 250-ton single-action Hydro-Dynamic press. First operation on press at right is pre-cupping flat disk blank. Blanks move from there into a second 250-ton press for cupping.

DRAWING—Third draw is made on this Bliss 125-ton press. Long punch stretches case to almost its final length. (Two more draws complete the job.) Long strokes combined with fast approach and return speeds suit this press to production of steel cases.

BLISS
SINCE 1857

is more than a name... it's a guarantee

E. W. BLISS COMPANY, Canton, Ohio

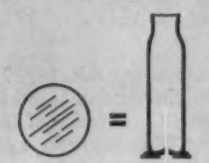
Presses, Rolling Mills, Rolls, Special Machinery

Steel Cartridge Case Lines

HYDRO BLISS DYNAMIC

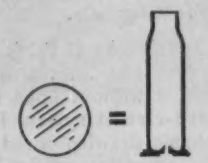
Eleven Press Operations On Each Line

ARMY



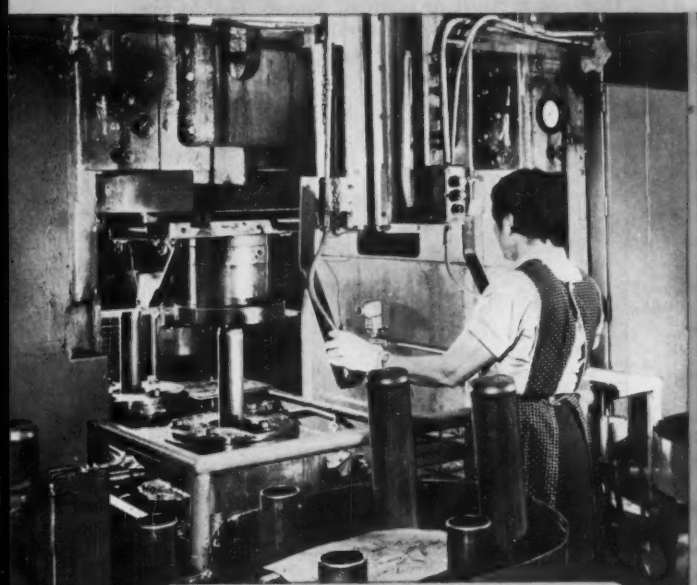
From this...to this

NAVY

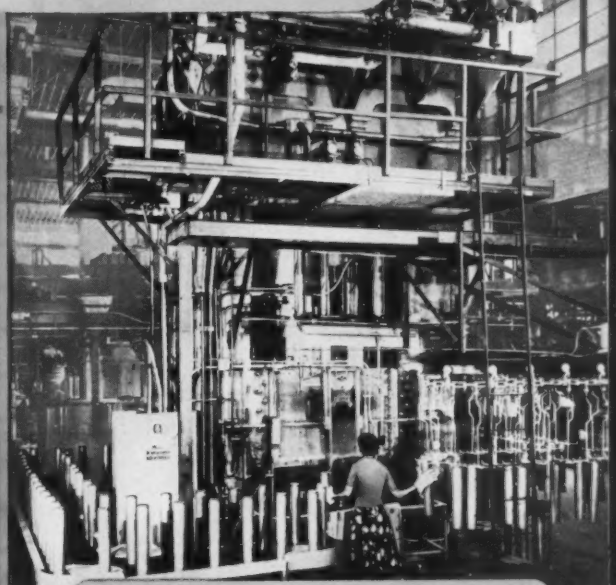


From this...to this

OPERATION	PRESS	CAPACITY
1. Pre-Cup	Bliss HS250	250
2. Cup	Bliss HS250	250
3. First Draw	Bliss HS200	200
4. Second Draw	Bliss HS150	150
5. Third Draw	Bliss HS125	125
6. Fourth Draw	Bliss HS100	100
7. Pre-Head	Bliss HS1500	1500
8. Fifth Draw	Bliss HS75	75
9. Head	Bliss HS2500	2500
10. First Taper	Bliss HS75	75
11. Second Taper	Bliss HS75	75



PRE-HEADING—This 1500-ton press, which pre-heads cases, is equipped with a Bliss-designed shuttle, allowing it to be loaded with one case while another is still in the press. Shuttle makes it easier to load and unload thus speeding production.

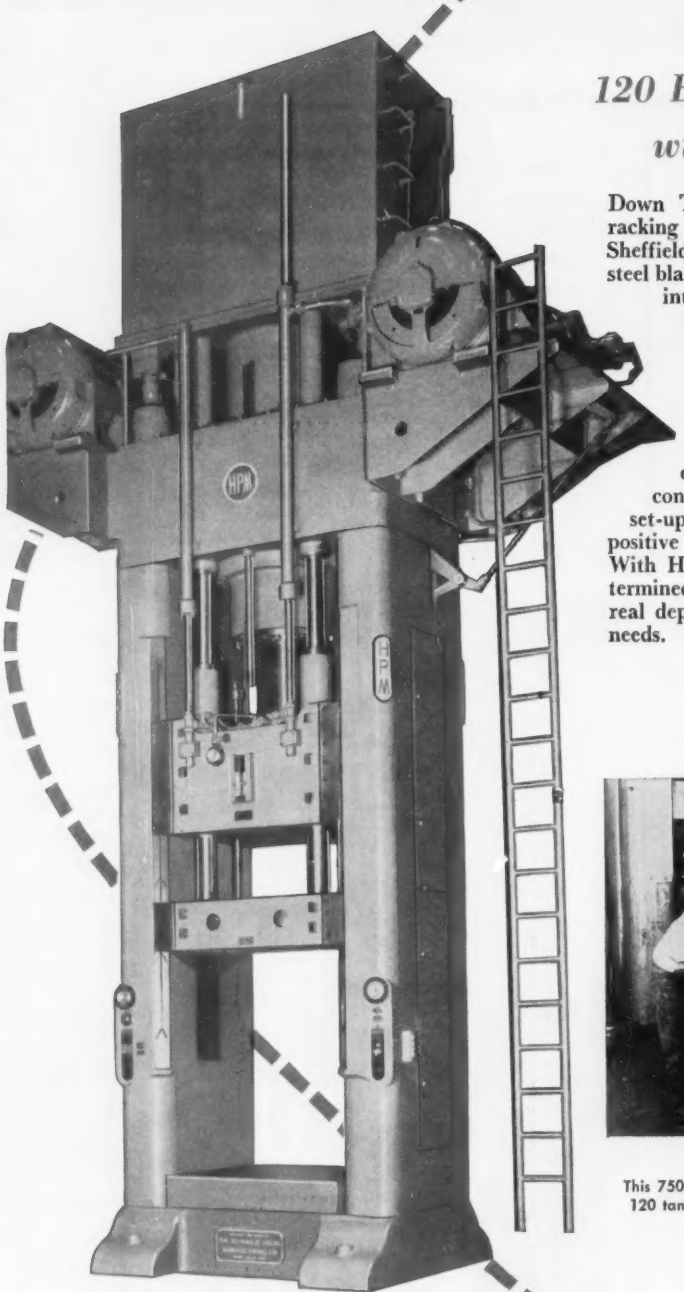


HEADING—Heaviest press in each line is a Bliss 2500-ton heading press. Large pumps on top provide smooth flow of high pressure oil to the slide. Pumps are simple and rugged, with peak rating well above maximum press tonnage.

U. S. Plants: Canton, Cleveland, Salem and Toledo, Ohio; Detroit and Hastings, Michigan; San Jose, California, Midland and Pittsburgh, Pa. *Branch Offices:* Boston, Burbank, Chicago, Cleveland, Dayton, Detroit, Indianapolis, New Haven, New York, Pittsburgh, Philadelphia, Rochester, Salem, San Jose, Toledo, Washington, D. C. and Toronto, Canada; E. W. Bliss (England) Ltd., Derby, E. W. Bliss Co., (Paris), France.

Other representatives throughout the world.

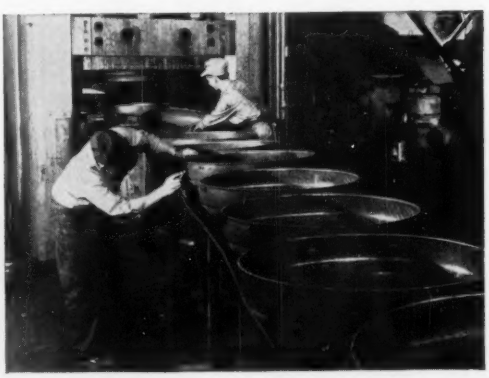
BIG THINGS WITH H-P-M PRESSES



120 Big Draws Every Hour with 750-Ton H-P-M

Down Texas way, this big 750-ton H-P-M is racking up impressive production figures for Sheffield Steel Corporation of Houston. The .210" steel blanks, 39" in diameter, are fed automatically into the press and drawn to a depth of 10". The finished tank heads are 30" in diameter; later welded to tank cylinders for gas storage use.

Here's why H-P-Ms really pay off for Sheffield . . . smooth fast drawing action without impact . . . fastraverse closed-circuit system for constant and controllable drawing speed . . . quicker die set-up . . . positive overload protection . . . positive blankholder pressure for entire draw. With H-P-Ms you have press reversal at predetermined pressure or position. Specify H-P-M for real dependability—for all of your metalworking needs. Write today for complete information.



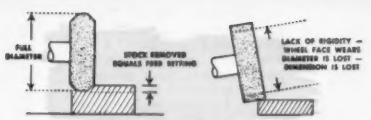
This 750-Ton H-P-M with automatic feeding device turns out 120 tank heads an hour for the Sheffield Steel Corporation.

For one dependable source...for one responsibility...for all your metalworking needs . . . specify H-P-M.

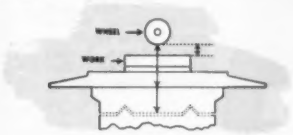
METAL WORKING DIVISION
THE HYDRAULIC PRESS MFG. CO.
Mount Gilead, Ohio, U.S.A.

HPM

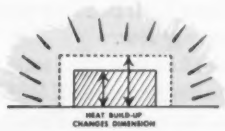
DoALL Takes the Guesswork out of Surface Grinding



The DoALL Maintains Wheel Diameter. The leading edge of the wheel takes the brunt of the cutting. The edge wears but the wheel face and diameter remain intact, assuring accurate stock removal. This is achieved by machine rigidity, smooth table travel and cross feed occurrence before the wheel contacts the workpiece.



The DoALL Maintains Table-to-Wheel Distance Under Load. Absence of spindle and saddle deflection plus a constant thickness oil film on all hand scraped ways assures parallel work travel under the wheel.



The DoALL Minimizes Thermal Expansion. DoALL "Cool-Grinding"* (coolant through the wheel) plus flood cooling controls workpiece temperature, minimizing expansion which produces undersize dimensions when work cools. Cool-Grinding helps to keep wheel cutting free, permits heavier downfeeds without burning or checking the workpiece and reduces the frequency of wheel dressing because diameters are maintained for longer grinding periods.

You get more output per hour because you don't have to stop to check dimensions . . .

The amount of work produced on a surface grinder depends on whether its feed calibrations represent an equivalent amount of stock removal. To grind, measure and then grind some more to secure final dimension is a costly waste of time.

DoALL takes the guesswork out of surface grinding because the wheel removes stock exactly according to downfeed setting. This reliability does not exist in all surface grinders. An accurate handwheel alone does not make an accurate surface grinder. Nor can accuracy be determined except under the stress of grinding, as illustrated at the left.

For true precision grinding with greatest output per hour, there is nothing to match a DoALL.

ASK FOR A FREE DEMONSTRATION — Compare a DoALL with any surface grinder in your shop. See it in operation on a DoALL demonstration wagon right in your own plant. Call your local DoALL Store or write:

The DoALL Company,
Des Plaines, Illinois

Ask for Grinder Catalog

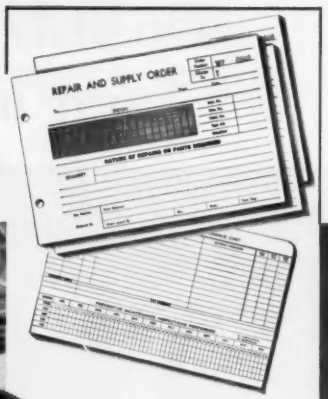
38 local DoALL Service Stores offer free demonstrations.

DoALL

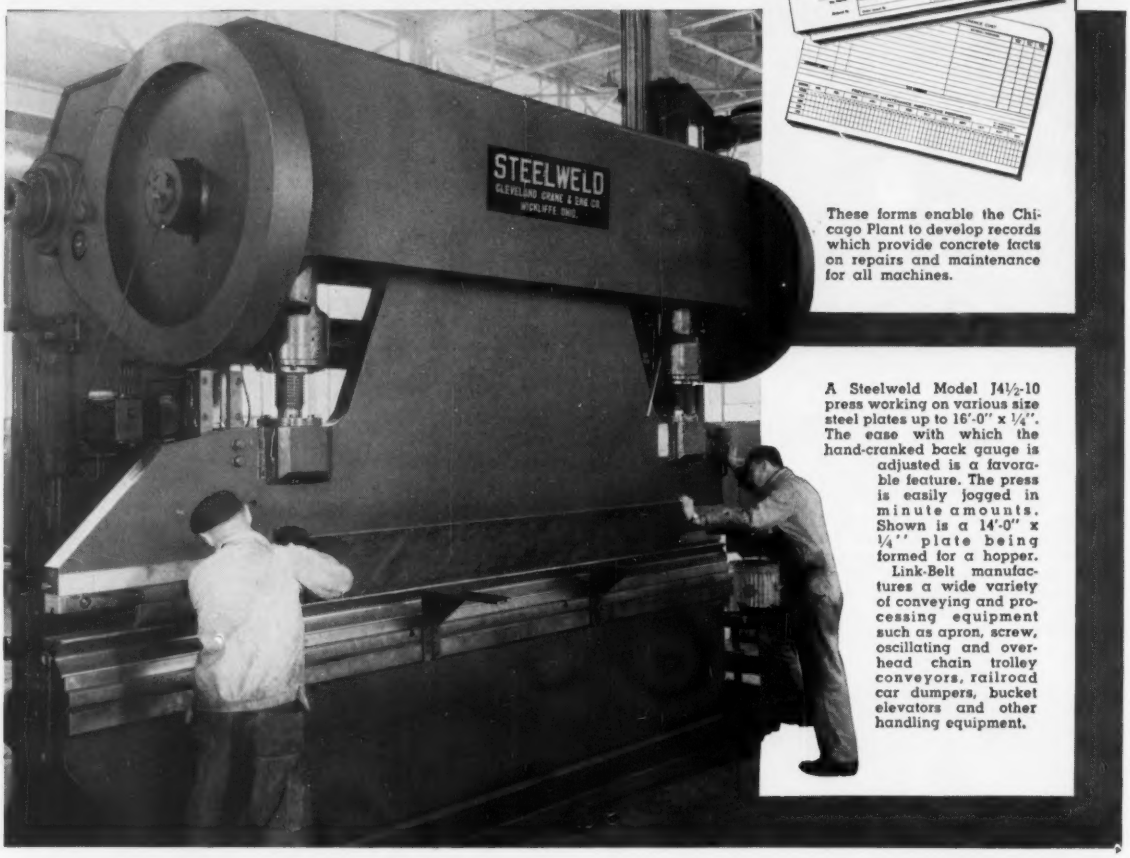
*U. S. Pat. No. 2470350

GR-16

Accurate Records Prove
LOW COST OPERATION



These forms enable the Chicago Plant to develop records which provide concrete facts on repairs and maintenance for all machines.



A Steelweld Model J4½-10 press working on various size steel plates up to 16'-0" x ¼". The ease with which the hand-cranked back gauge is adjusted is a favorable feature. The press is easily jogged in minute amounts. Shown is a 14'-0" x ¼" plate being formed for a hopper.

Link-Belt manufactures a wide variety of conveying and processing equipment such as apron, screw, oscillating and overhead chain trolley conveyors, railroad car dumpers, bucket elevators and other handling equipment.

SOME YEARS AGO the Pershing Road Plant of Link-Belt Company, Chicago, established a record system for keeping track of repairs and maintenance costs of all machine tools. This system provides a detailed history of maintenance required and lists every item of expense for every machine.

The record system proves that the maintenance cost for Steelweld machines, both bending presses and shears, is comparatively low.

Because of this, and the fact that Steelweld machines have many desirable operational features, a number of which are unavailable elsewhere, Link-Belt regards them highly. In fact, so much that 20 Steelweld Presses and Shears are now serving Link-Belt plants in nine cities.

GET THIS BOOK!

CATALOG No. 2010 gives construction and engineering details. Profusely illustrated.

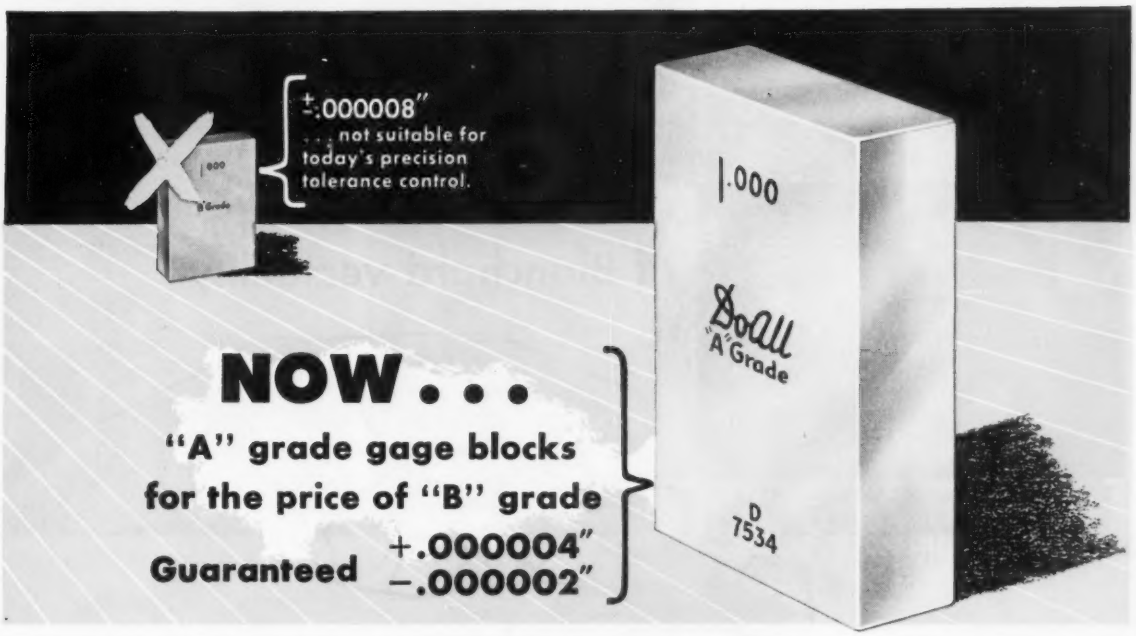
THE CLEVELAND CRANE & ENGINEERING CO.

5459 East 281 Street, Wickliffe, Ohio

STEELWELD
BENDING PRESSES

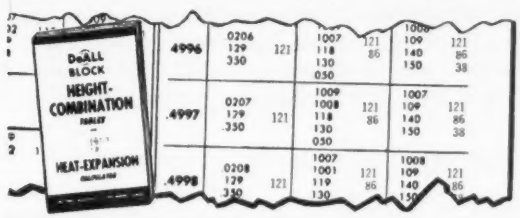
BRAKING • FORMING • BLANKING • DRAWING • CORRUGATING • PUNCHING

Why "B" Grade Gage Blocks Cannot Meet Today's Needs...



Here is Why: Consider .0001", a common part tolerance today. The checking gage must be accurate to .000010"—equal to or better than the accuracy of many gage blocks in common use! For example, a new one-inch gage block is acceptable as grade "B" if accurate to ± .000011", including observational errors. A single two-inch block could have a permissible error of ± .000020", amounting to 20% of the .0001" tolerance.

Such inaccuracies may be greatly multiplied when a stack of blocks is used. For example, in checking a shaft



dimension of 2.4977 (± .0001") a minimum of five blocks from an 86 piece set would be required. Assuming the most favorable combination—one two-inch block and four others—the stack *could* vary plus or minus .000064" (over a half-tenth). This is more than half the allowable tolerance of the part itself! If some of the individual blocks were plus and some minus, the total error would be less—but how much less?

When dealing with critical tolerances, "B" grade blocks just aren't adequate. Contrast them with DoALL "A" Grade Blocks *now available for the price of "B" Grade.*

New DoALL "A" grade standards are plus .000004", minus .000002" maximum error per inch of length. Surface finish is guaranteed 0 to 0.09 RMS microinches, permitting calibration to within tenths of a millionth of exact size. Here is working accuracy you can rely upon —accuracy that eliminates need for calculating calibrated sizes, prevents errors, saves time and money. Why have less? Get the facts about DoALL's new gage block standards that meet today's needs. Remember, DoALL offers "A" Grade Gage Blocks at "B" grade prices.

Ask for Catalog—Call your local DoALL Store, or write

THE DoALL COMPANY

Des Plaines, Illinois

FREE — "How To Be Your Own Bureau of Standards" — tells how to inspect and calibrate gage blocks in your own shop. The only manual of its kind. Your copy free on request.

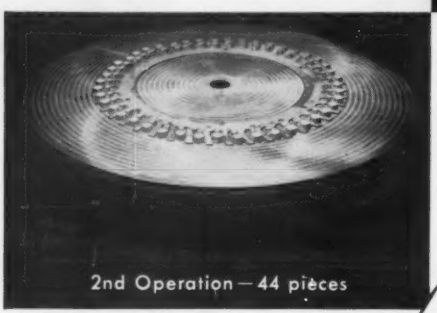
FRIENDLY DoALL STORES IN 38 CITIES give you personalized service and local delivery from complete stocks

For more information fill in page number on Inquiry Card, on page 241

Another example

1st Operation—653 pieces

W-1138



2nd Operation—44 pieces

W-1139

# of Blanchard versatility

No. 303 Stainless Steel Forging

653 oddly shaped, non-magnetic workpieces

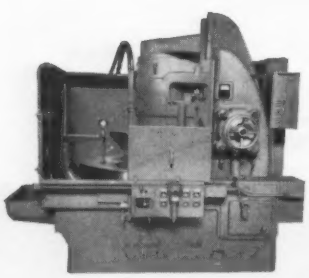
Blanchard Surface Grinders are noted for their unusual versatility—like grinding small, non-magnetic stainless steel forgings in quantity.

In the first operation, 653 forgings are loaded and blocked between rings on a No. 18 Blanchard, with 36" magnetic chuck (stock removal .010"). Parts, chuck and rings are sprayed with oil, and molten sulphur is poured around the parts to hold them. After grinding, the sulphur is easily stripped away.

This entire operation takes only 1½ hours—including preparation of the sulphur.

In the second operation, 44 pieces are set in a notched steel ring. Tilting the wheelhead and maintaining wheel pressure in one direction holds these non-magnetic pieces in the notches. Stock removal from this surface is .030", to tolerance of =.003. Each load takes eight minutes—floor-to-floor.

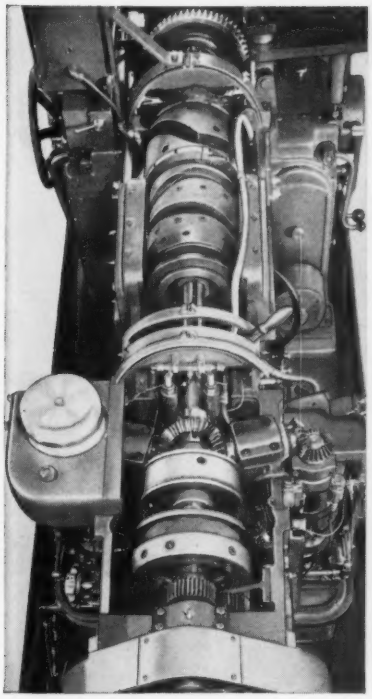
As a result of this ingenious workholding, each piece is ground on both sides in a fraction of a minute, at less than 98¢ abrasive cost for all 653! That's typical of the convenience and economy of grinding on a Blanchard—whether the parts are magnetic or non-magnetic!

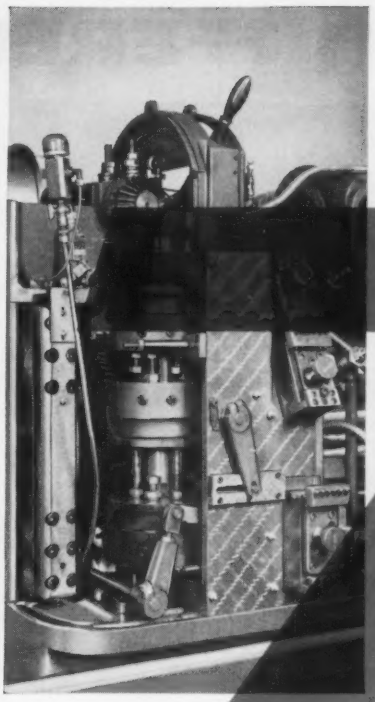


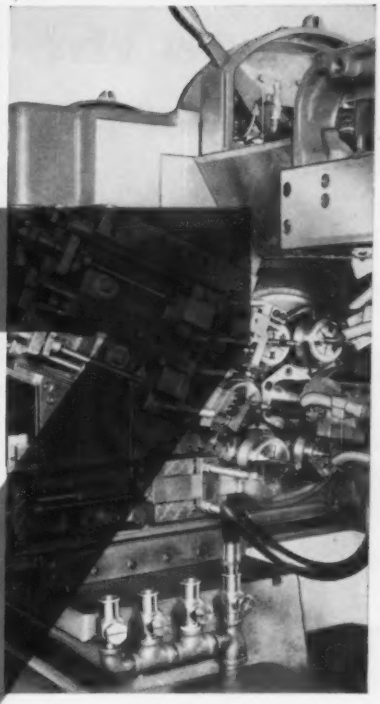
Send for free copies of "Work Done on the Blanchard", 4th edition, and "The Art of Blanchard Surface Grinding", 3rd edition—recently revised.

PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE COMPANY **64 STATE ST., CAMBRIDGE 39, MASS., U. S. A.**





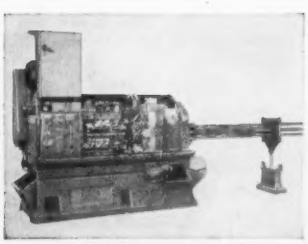


Seven Fast Changeover Models

With the prospects of improved tool materials ever decreasing the actual machining time of work on Multiple Spindle Automatics, long runs tend to become short runs. Facility that decreases the time for job changes becomes more important to low-cost production.

Conomatics are available in as many as seven fast changeover models. These are the 9/16", 1", 1 5/8" Sixes, and the 2 5/8", 3 1/2", 5", and 5 1/4" Fours.

These models are equipped with dial adjustment of working stroke of all slides, without making necessary change of total stroke or positive stop settings. Write, wire, or phone for literature descriptive of these features and other facilities available to users, or prospective users.



Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U. S. A.

For more information fill in page number on Inquiry Card, on page 241

what's the DIFFERENCE...

the DIFFERENCE is...

To you, the user or buyer, the most important difference between MARVEL High-Speed-Edge Hack Saw Blades and ordinary blades is the *unequalled* performance you get from MARVEL Blades.

Performance reflected in higher production (faster cutting-off), greater accuracy of cut-off blanks, and longer blade life has made MARVEL the preferred blade in every kind of metal sawing operation.

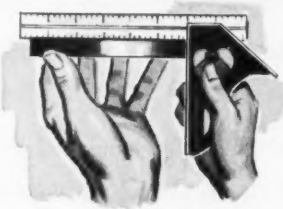
To get the *difference* in performance, always insist on MARVEL High-Speed-Edge Hack Saw Blades. Leading Industrial Distributors have them in stock.

Write for "The MARVEL Story." It has complete details on MARVEL High-Speed-Edge Hack Saw Blades and Hole Saws.

HIGHER PRODUCTION

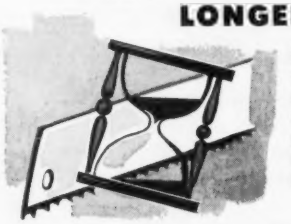
Unbreakable MARVEL High-Speed-Edge Blades can be worked faster and harder than any other blade with complete safety. They will withstand the highest speeds and heaviest feeds attainable on any make hack sawing machine. MARVEL Blades will cut any machineable metal. No wasted time changing blades for different materials.

GREATER ACCURACY



Composite construction permits MARVEL Blades to be tensioned from 200% to 300% more taut than ordinary blades. This produces greater rigidity of the high-speed-steel cutting edge, resulting in maximum obtainable accuracy of cut-off blanks.

LONGER BLADE LIFE

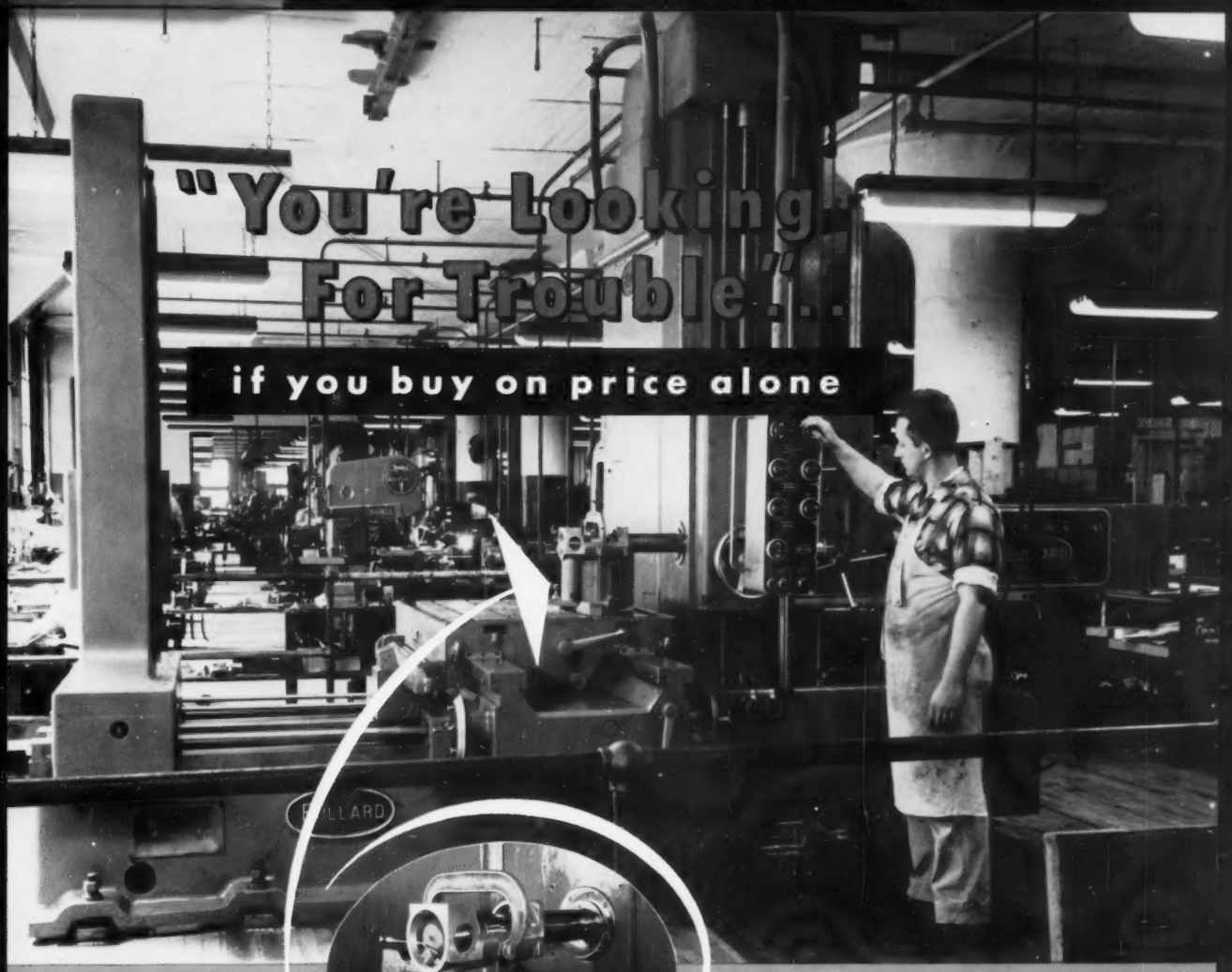


Each MARVEL High-Speed-Edge Hack Saw Blade is triple tempered to assure maximum toughness of the cutting edge. MARVEL Blades not only give you longer life, they assure a *more efficient* cutting life, with resulting lower blade costs.

B-1121

ARMSTRONG-BLUM
MFG. CO.
5700 WEST BLOOMINGDALE AVE. • CHICAGO 39, ILL.

MARVEL *Metal Cutting* SAWS
Better Machines–Better Blades



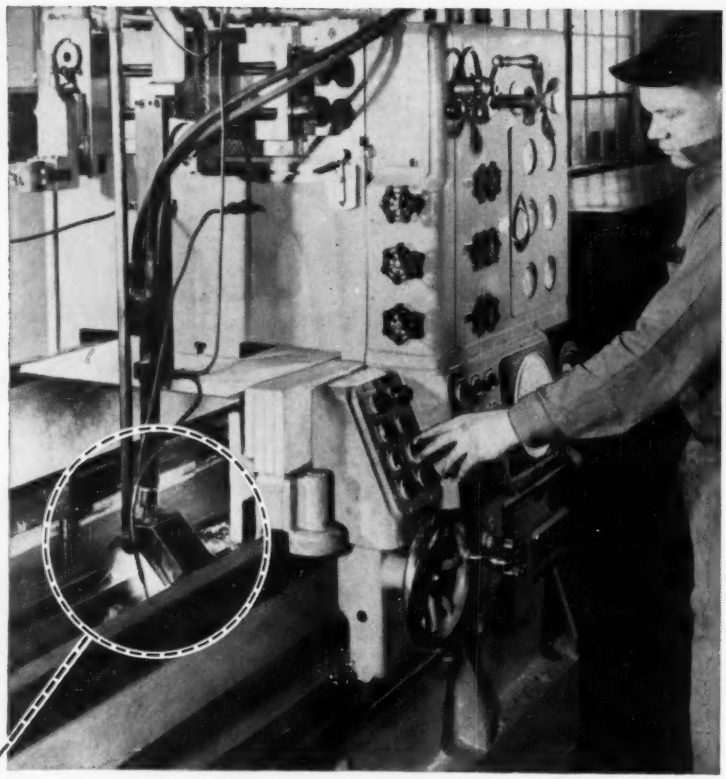
BULLARD

"Like many other firms," says Mr. A. Balas, Equipment Engineer at Mergenthaler Linotype Co., N.Y.C., "we are constantly on the alert for new equipment, new processes and new ideas. This constant search for improvement convinced us of the need to purchase a versatile, time-saving, cost-saving and, above all, accurate Horizontal Boring Machine. We checked them all — feature for feature — and then bought the Bullard H.B.M., Model 75. We feel it has enough "built in reserves" to take care of any contingency or new development which may come up. It's reassuring to know that an investment of this size won't go out of style next month."

Why don't you get the full story on the many features and advantages offered you with a Bullard H.B.M., Model 75 in your plant. For a complete line catalog, just call your nearest Bullard Sales Office, Distributor or write

THE BULLARD COMPANY BRIDGEPORT 9, CONN.

HIGH SPEED FLAME-HARDENING



Cross-section view shows uniform depth of hardened surface.

SPECIAL MACHINE UPS LIFE OF GRAPHITIC STEEL PARTS

LINDE engineers have assisted Cincinnati Steel Treating Company in developing a flame hardening machine which increases service life of 16 ft. long, graphitic carbon steel lathe ways . . . Development of this automatic, high speed machine is another example of how LINDE Service Engineers are helping LINDE's customers up production speed and unit quality through co-operative research engineering.

With this new machine, a lathe way to be treated is placed on a magnetic chuck in a water filled channel. Flame-hardening heads and control mechanism move at predetermined speeds along the part. After it cools, the lathe way is placed in a refrigerator for 24 hours which stabilizes the steel, and brings its case hardness to a minimum of 60 Rockwell "C" scale.

The benefits of LINDE's research, engineering, and over 40 years of accumulated know-how stand behind each of its customers to help them solve production problems. Get these "plus-values" which LINDE offers—it pays you to do business with LINDE.

Linde Air Products Company
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York 17, N. Y.
Offices in Other Principal Cities
In Canada: LINDE AIR PRODUCTS COMPANY
Division of Union Carbide Canada Limited, Toronto

The term "Linde" is a registered trade-mark of Union Carbide and Carbon Corporation.

Linde Trade-Mark

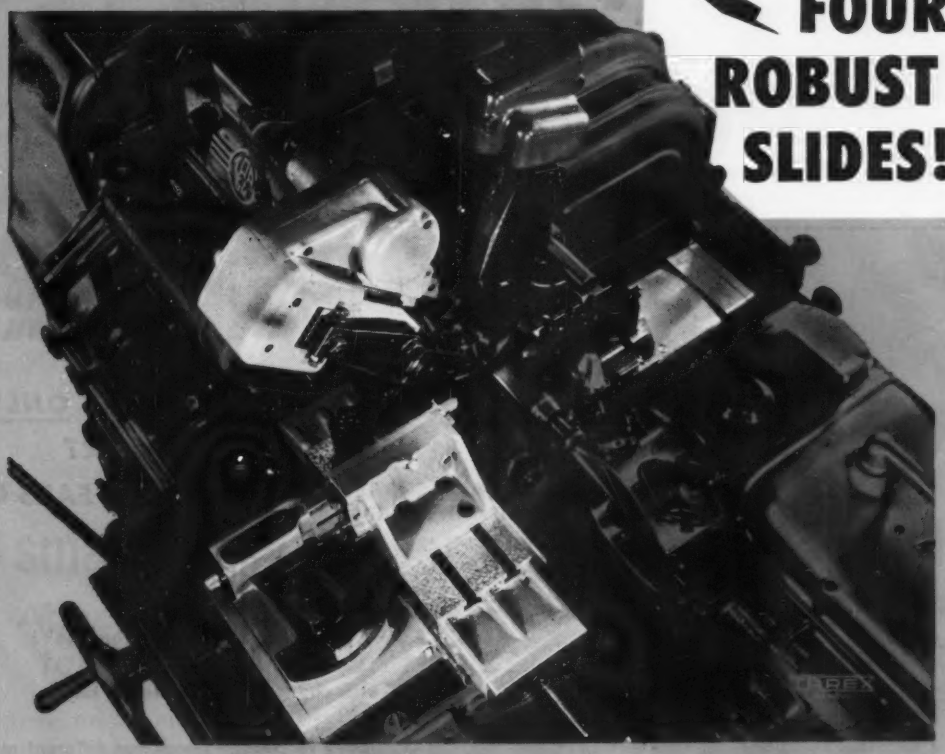
For more information fill in page number on Inquiry Card, on page 241

TAREX

AUTOMATICS

. . . here's JUST ONE of the salient features of this machine which is made with SWISS PRECISION throughout:

FOUR ROBUST SLIDES!



The front and rear slides mounted on crossed ways, *permitting radial or lateral movements, or combined to produce tapers or irregular forms.* This allows the use of single point tools in many cases in place of form tools with their inherent side thrust. All tool slides actuated by camming systems having adjustable ratios. (The two upper slides are radial only). Machine throughout is engineered to take American-made tools!

COMPLETE TOOLING and SERVICE in AMERICA.

RUSSELL, HOLBROOK & HENDERSON, INC.

292 Madison Avenue, New York 17, N. Y.

CUT REPLACEMENT COST More than Half

with NEW T-J REAMERS

REPLACE ONLY THE PART THAT WEARS OUT!

1. **Cuts replacement cost to less than half!**
2. **Quick change of heads saves time.**
3. **Easy to change heads for different metals, increases efficiency.**
4. **Head and arbor firmly locked together.**
5. **Wide range of sizes.**

Exclusive in design . . . the New-type T-J Reamers cut your replacement costs to *less than half!* Only the quickly installed *head* to replace, after buying original shank. Wide range of interchangeable heads from ½" to 2¾" inclusive, in 1/16" increments are available with right or left hand spiral flutes for thru or blind hole reaming.

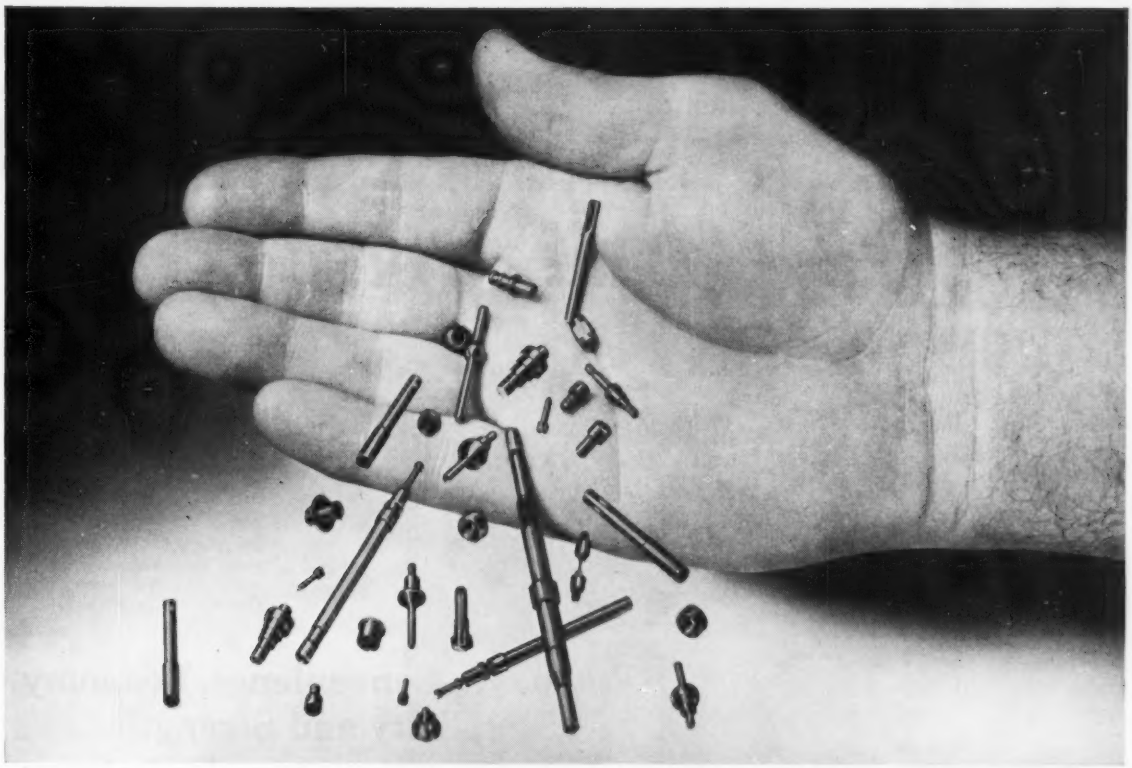
Tapered hole in head insures concentricity and *new* thread design assures a snug fit on smoothly ground tapered shank. Reamer operates free from binding or sticking due to cutting portion wearing undersize and creating negative relief. Backed by T-J's 39 years of know-how as one of the largest manufacturers of die sinking milling cutters.

Tomkins-Johnson Co., 617 North Mechanic Street, Jackson, Michigan.

Exclusive, high potential territories open to responsible manufacturers representatives. Write today!

T-J TOMKINS-JOHNSON
RIVITORS...AIR AND HYDRAULIC CYLINDERS...CUTTERS...CLINCHORS

39 Years Experience



Do small parts like these give you large problems?

Anaconda Rod solved costly production problems for G & F Manufacturing Company, Philadelphia

The trend toward miniatures has led to a tremendous increase in the use of small precision parts like these. And this has placed a heavier burden on the screw machine operator and the buyer of rod. Uniformity of alloy and dimension in batch after batch of screw machine rod is vital for economical production.

ONE COMPANY'S PROBLEM: The G & F Manufacturing Company of Philadelphia specializes in automatic screw machine production of minute parts, finished to precise dimensions. This company was experiencing costly production delays with the rod they were using, due to jamming and freezing of the rod as it was fed into the machines.

THE SOLUTION: Then G & F tried Anaconda Free Cutting Brass-271 Rod in the diameters required for their type of small-part production. They found it highly satisfactory. Down time, due to jamming or freezing of the rods, has been practically eliminated and production schedules are completed without costly interruption.

Whether for small parts of extreme accuracy—or for ordinary screw machine production—The American Brass Company can furnish free-cutting copper and copper-alloy rods fabricated to meet the requirements of the operation—uniform in length, diameter, temper and composition.

FREE TECHNICAL SERVICE: It is the function of the Technical Department of The American Brass Company to assist metal users in the solution of special problems. This service is at your disposal without charge or obligation.

Comprehensive data on composition and machinability of standard Anaconda Alloys, standard specifications, weights and dimensions of standard rods is available in Publication B-3. For this booklet—for special technical assistance—write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

5462

ANACONDA® RODS FOR SCREW MACHINE PRODUCTS

For more information fill in page number on Inquiry Card, on page 241

New

ARMSTRONG

Armide CARBIDE INSERT TOOL HOLDERS

STYLE TR
(opposite Hand TL)
Holds Triangular 6-edge, Armide and other carbide "throw-away" inserts.

STYLE SR
(opposite Hand SL)
Holds square, 8-edge, Armide and other carbide "throw-away" inserts.

Embody...Convenience, Economy Simplicity and Strength based on these superior features:

- **IMPROVED CLAMPING METHOD—speeds indexing of inserts.**
- **REPLACEABLE SEAT of Hardened Tool Steel—protects shank and provides flat base to prevent damage to inserts as they are clamped in position.**
- **SHANK of Heat Treated Alloy Steel—gives extra strength and rigidity.**

A slight turn of a single screw permits rapid indexing of the ARMIDE insert—reducing down time to a minimum.

The use of ARMIDE "throw away" inserts provides the economy of multiedged inserts—triangular inserts have six, square inserts eight cutting edges. These are available in Utility or Precision finish and in three grades of ARMIDE: 350, 370 or 883.

Protection to the shank is given by the replaceable tool steel seat which prevents wear and damage to the shank and provides a flat base for the insert reducing the possibility of damage to the insert as it is clamped in place. A relief groove is ground into the seat providing clearance when a dulled insert with "built up" edges is turned over.

ARMSTRONG ARMIDE Carbide Insert Tool Holders are furnished in two styles and three sizes. Complete data on these tools is given in Bulletin CIT, mailed on request.

Buy **ARMSTRONG TOOLS** from your Industrial Distributor

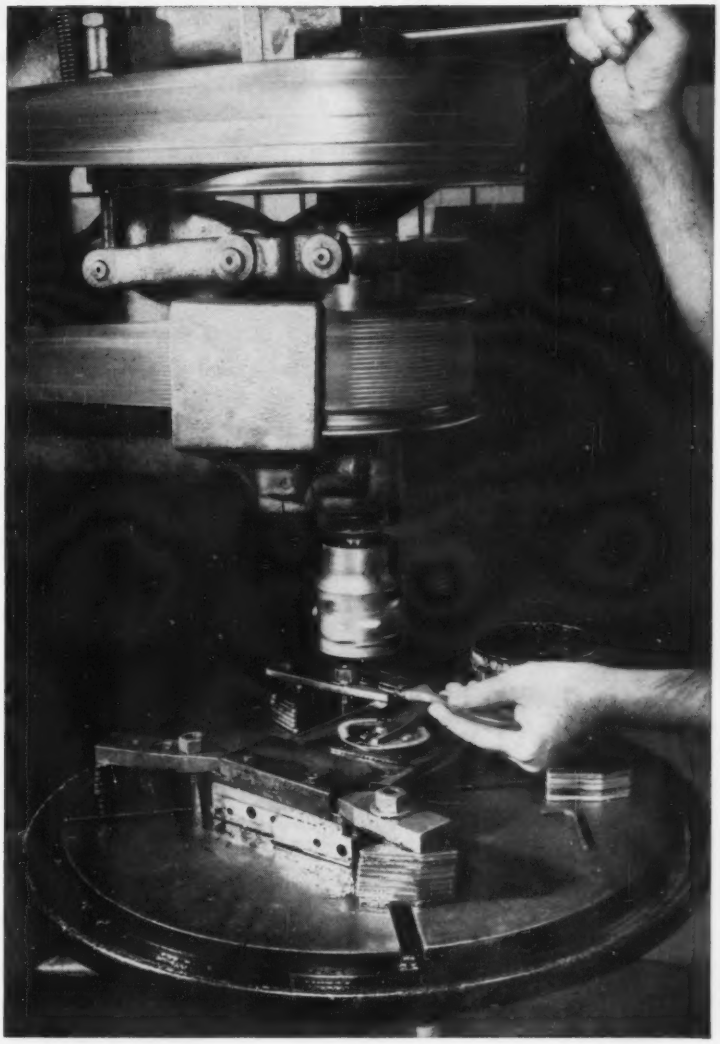
Write for catalog

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

5213 W. ARMSTRONG AVENUE **CHICAGO 30, ILL.**

"INCREASED TAP LIFE FROM 250 TO 4000 PIECES"



Cities Service Chillo Cutting Oil produces astounding results for C.S.S. Machine & Tool Company, Philadelphia, Pa.

Metal stamping . . . precision grinding . . . machining . . . stud welding . . . tool and die making. These are some of the expert operations performed by the 120 skilled employees of C.S.S. Machine & Tool Company of Philadelphia . . . operations based on many years' knowhow and teamwork. And for the past year, with Cities Service cutting fluids, this work has been done with even greater precision, greater efficiency than ever before.

In its tapping operation, for example, C.S.S. increased tap life from an average 250 pieces to over 4000 pieces with Cities Service Chillo Cutting Oil. And in a drilling operation with its Brown and Sharpe Automatics, time required to make one piece was cut from 240 to 165 seconds!

Says President F. G. Schutz: "Cities Service Chillo Cutting Oils are the best we've ever seen. Likewise, Cities Service Lubrication Engineers. It's wonderful to deal with someone who knows our operation so well and has products that help improve it."

If you have a lubrication problem, or even if you're running smoothly, talk with a Cities Service Lubrication Engineer. He's known for solving problems, known for making smooth operations still smoother. Or, if you prefer, write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

For more information fill in page number on Inquiry Card, on page 241

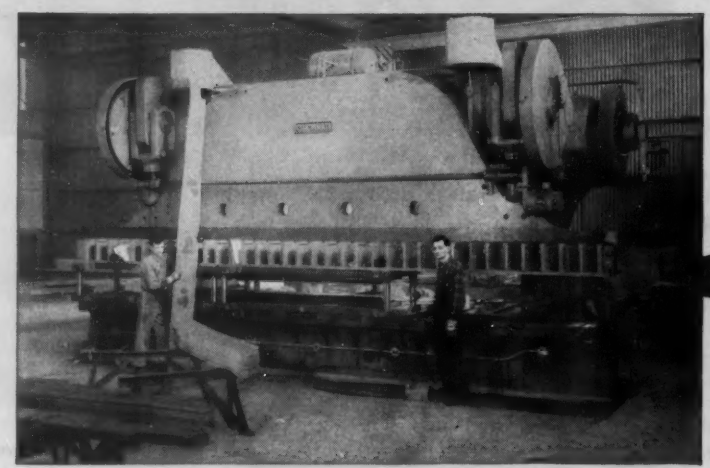
70 minutes cut

on combined blanking and punching operations!

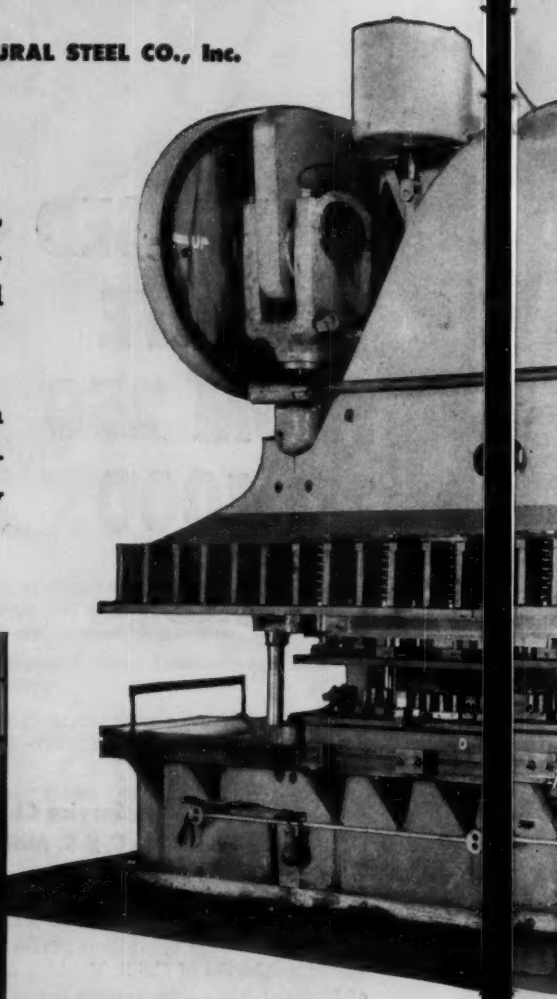
—FORT WAYNE STRUCTURAL STEEL CO., Inc.
Fort Wayne, Ind.

This versatile Cincinnati All-Steel Press Brake, 34 Series x 16′, has revolutionized the production of these long motor truck side rail reinforcements.

Check with our die engineering department on the application of a versatile Cincinnati All-Steel Press Brake in your shop. It can sharply reduce your production costs.



(A) Blanking floor to floor time 1¼ minutes. Previous time 34 minutes.



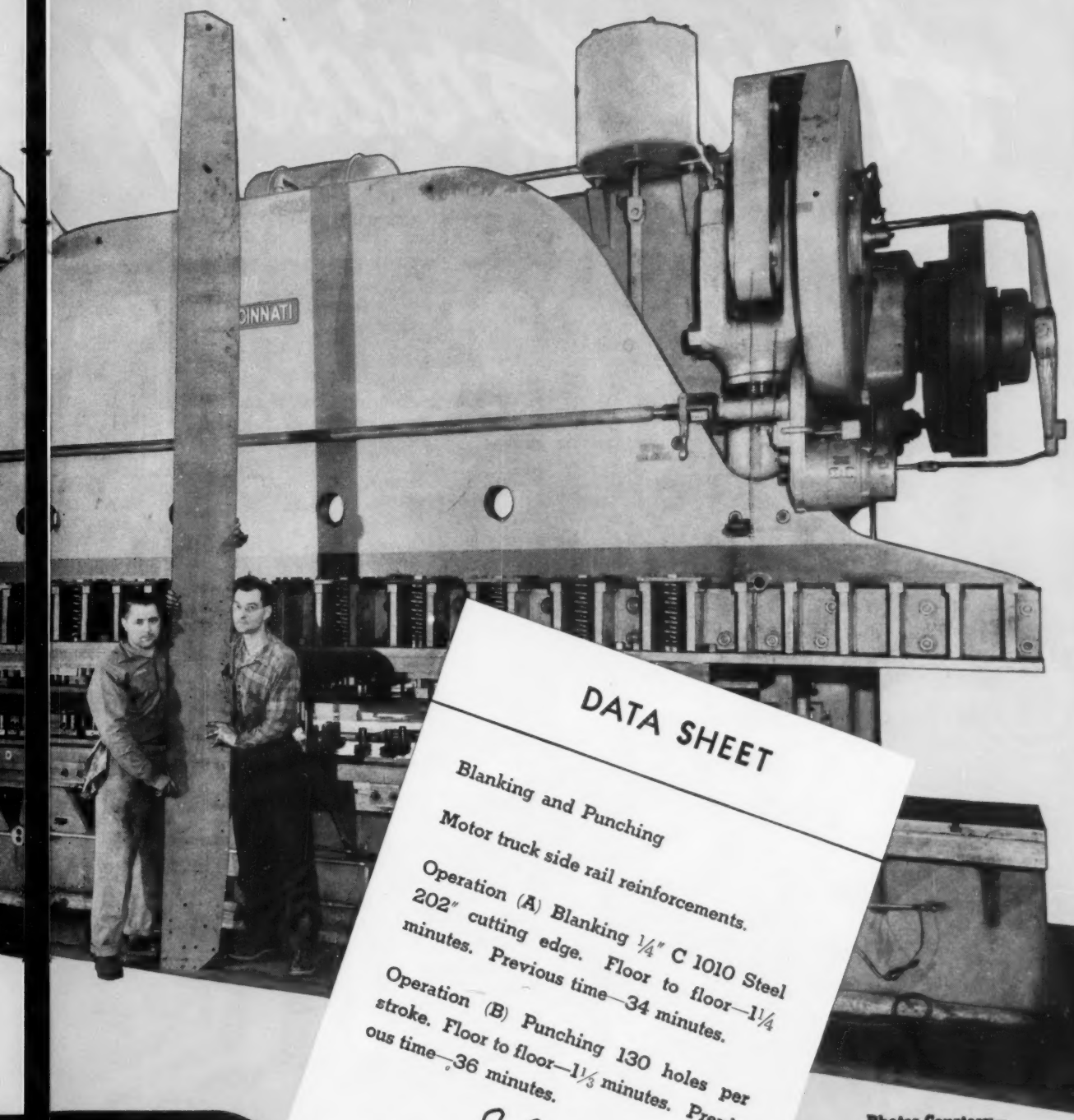
(B) Note Fort Wayne's ingenious punching equipment which reduced punching time from 36 minutes to 1⅓ minutes and took advantage of every versatile Cincinnati feature.

CINCINNATI

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

to 2.6 minutes...



DATA SHEET

Blanking and Punching

Motor truck side rail reinforcements.

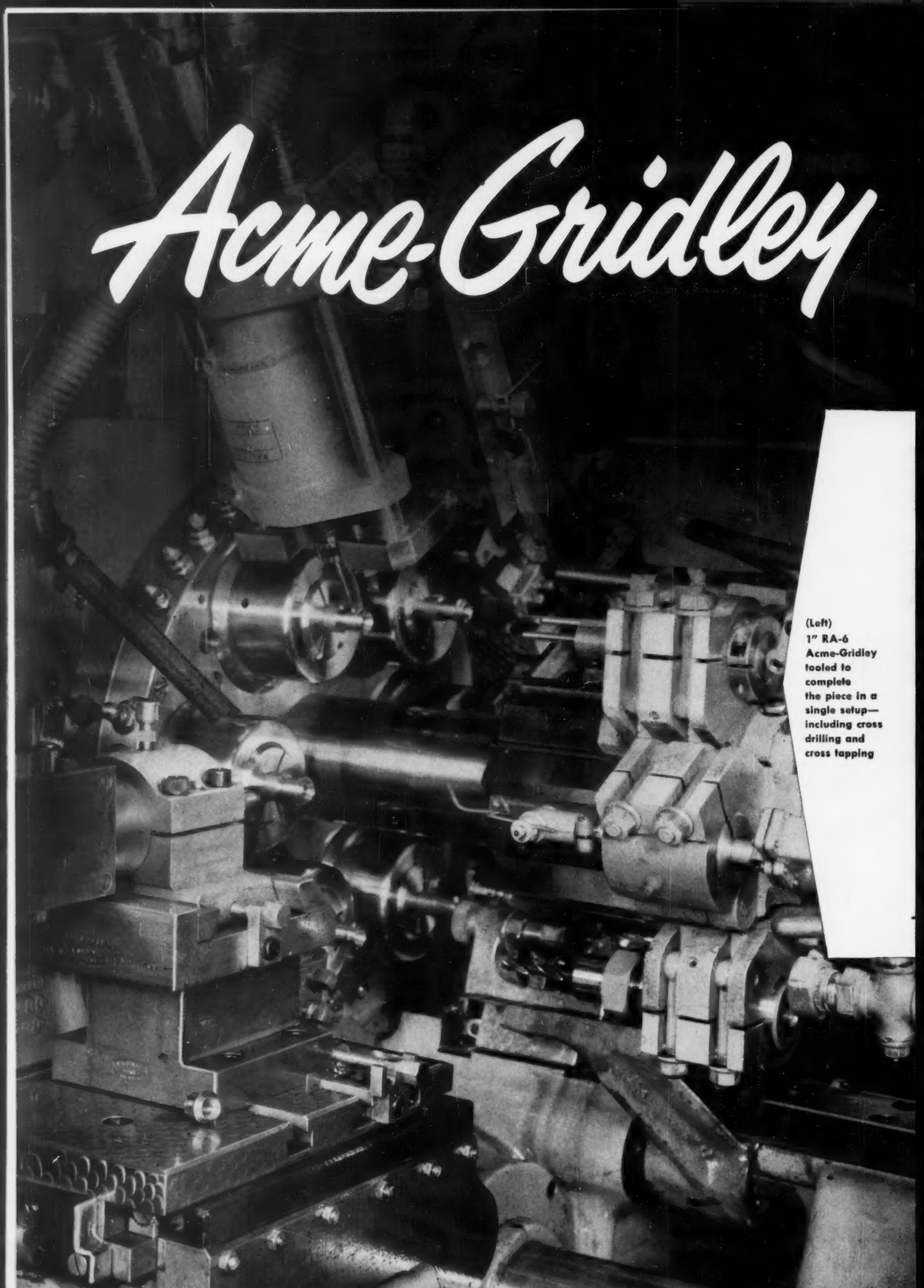
Operation (A) Blanking 1/4" C 1010 Steel 202" cutting edge. Floor to floor—1 1/4 minutes. Previous time—34 minutes.

Operation (B) Punching 130 holes per stroke. Floor to floor—1 1/3 minutes. Previous time—36 minutes.

John L. Hayner
President

Photos Courtesy—
FORT WAYNE STRUCTURAL STEEL CO., Inc.
Fort Wayne, Indiana

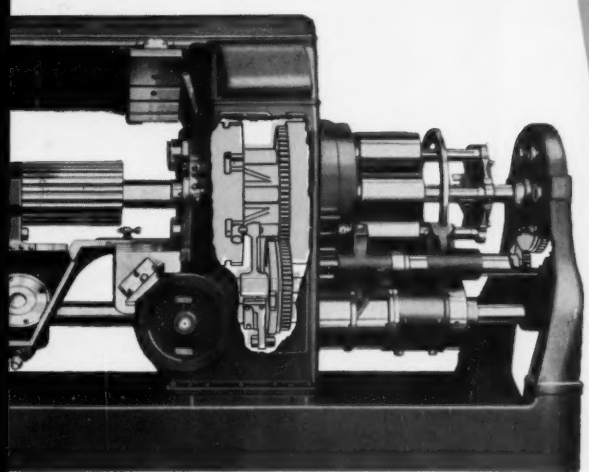
Acme-Gridley



(Left)
1" RA-6
Acme-Gridley
tooled to
complete
the piece in a
single setup—
including cross
drilling and
cross tapping

shockless indexing combined with independently-powered stock reel..

gives greater sustained accuracy... longer machine life



SHOCKLESS, POSITIVE INDEXING of the spindle carrier at high speed is accomplished by a Geneva mechanism. Indexing starts smoothly from a standstill, rapidly accelerates, then decelerates and comes to a dead stop without shock. Accurate location and positive locking of the carrier is assured by the locking pin mechanism.

STOCK REEL IS INDEPENDENTLY POWER INDEXED through a separate shaft and gear. This eliminates torsional strain and any tendency to whipping action, which might cause excessive wear on spindles and spindle carrier.

Acme-Gridleys are at their productive best when performing "secondary" operations during the primary setup—operations which otherwise would require additional time, machine investment, and floor space.

On an Acme-Gridley you can perform operations that require "on-the-button" indexing—such as cross-drilling and cross-tapping in successive spindle positions—with the same fourth-decimal-point-accuracy at the end of the shift as at the start.

And—your Acme-Gridley has power and stamina to spare, at the highest speeds and feeds that modern cutting tools can safely stand.

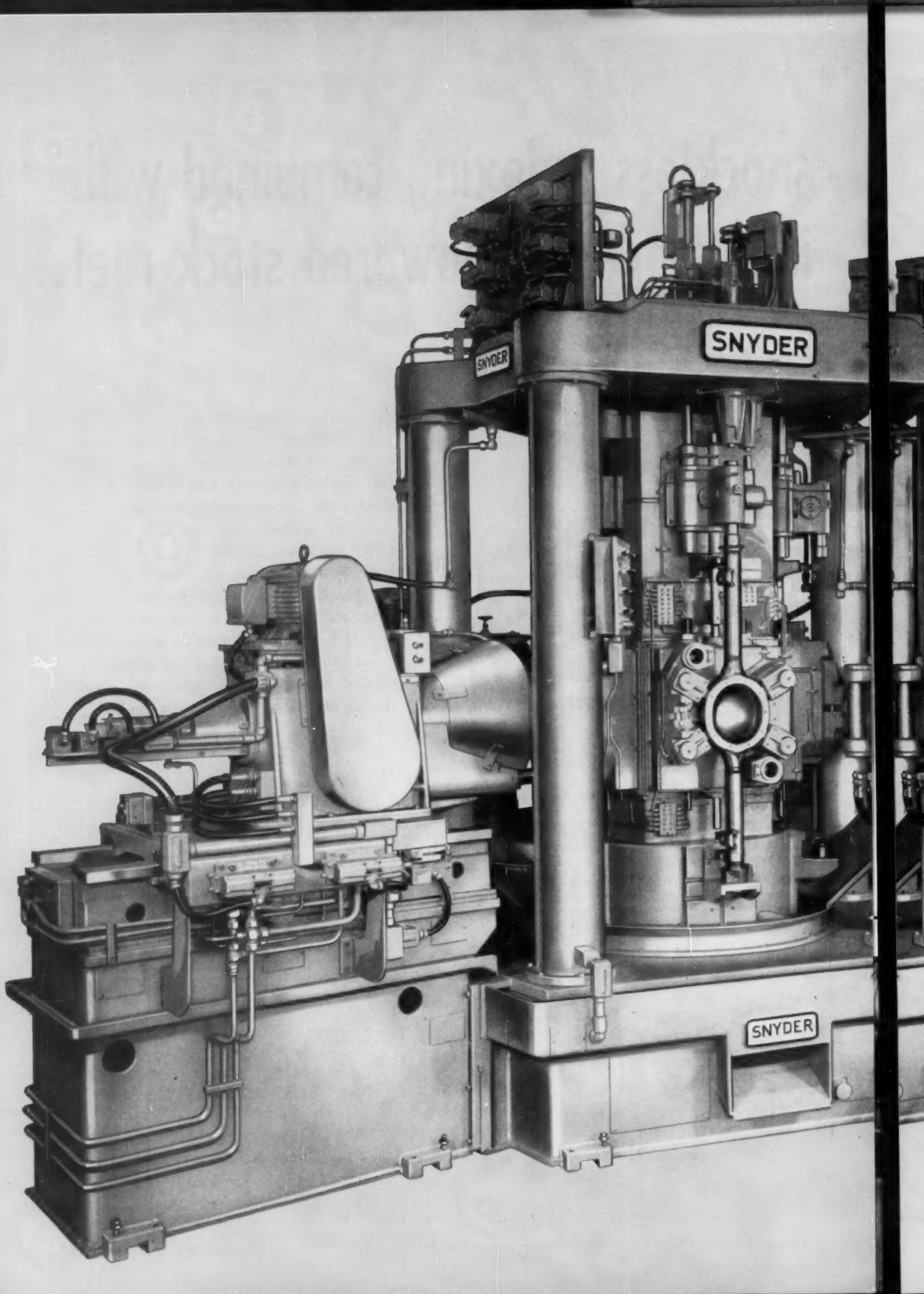
LET US TELL YOU MORE ABOUT
***Acme-Gridley* BASIC DESIGN**

This is but one of many BASIC DESIGN features which are responsible for Acme-Gridley's outstanding performance records. May we send you additional information? Or, better yet, let us send a representative to discuss possible production short cuts with you.

National Acme

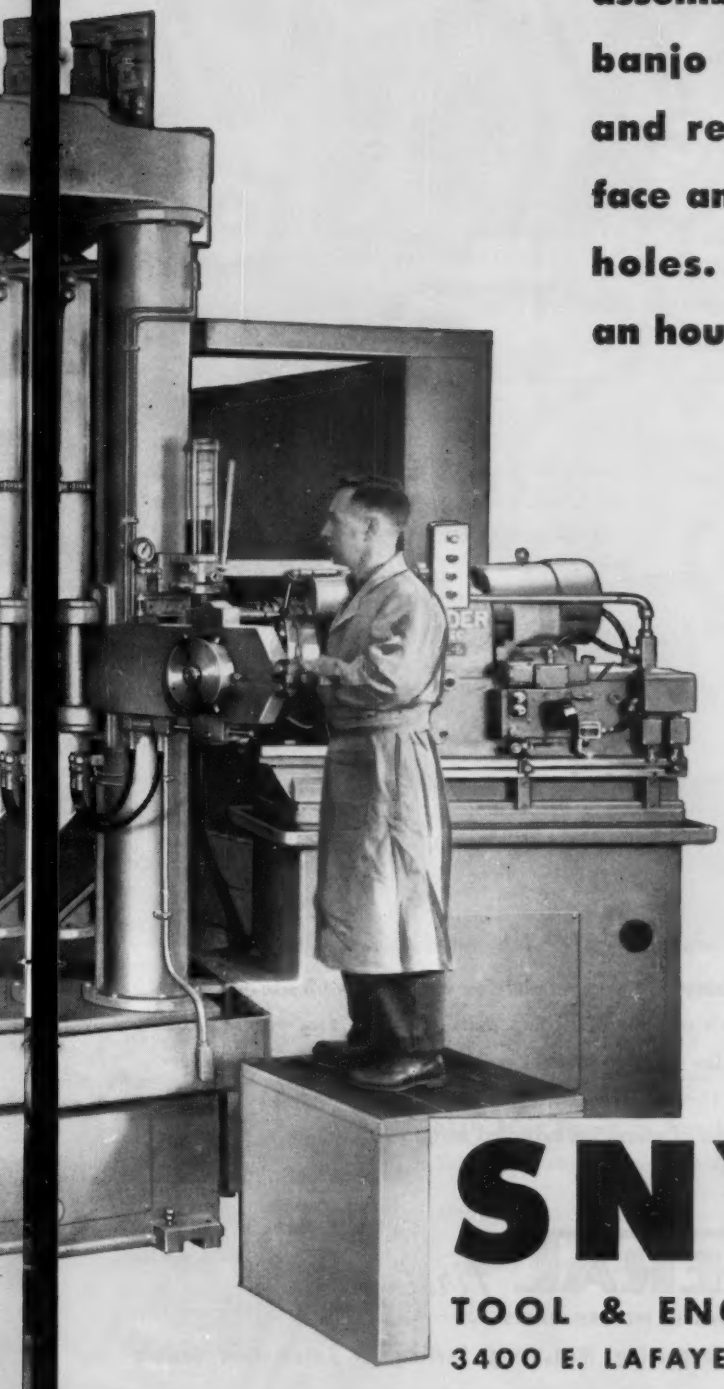
THE NATIONAL ACME COMPANY • 179 EAST 131ST STREET • CLEVELAND 8, OHIO

SALES OFFICES: • Newark 2, New Jersey • Chicago 6, Illinois • Detroit 27, Michigan


SNYDER
SNYDER
SNYDER

SNYDER VERTICAL TRUNNION MACHINE

for processing rear axle housing assembly; rough and finish faces banjo face, combination drills and reams ten holes in banjo face and chamfers both sides of holes. Production: 105 pieces an hour at 100% efficiency.



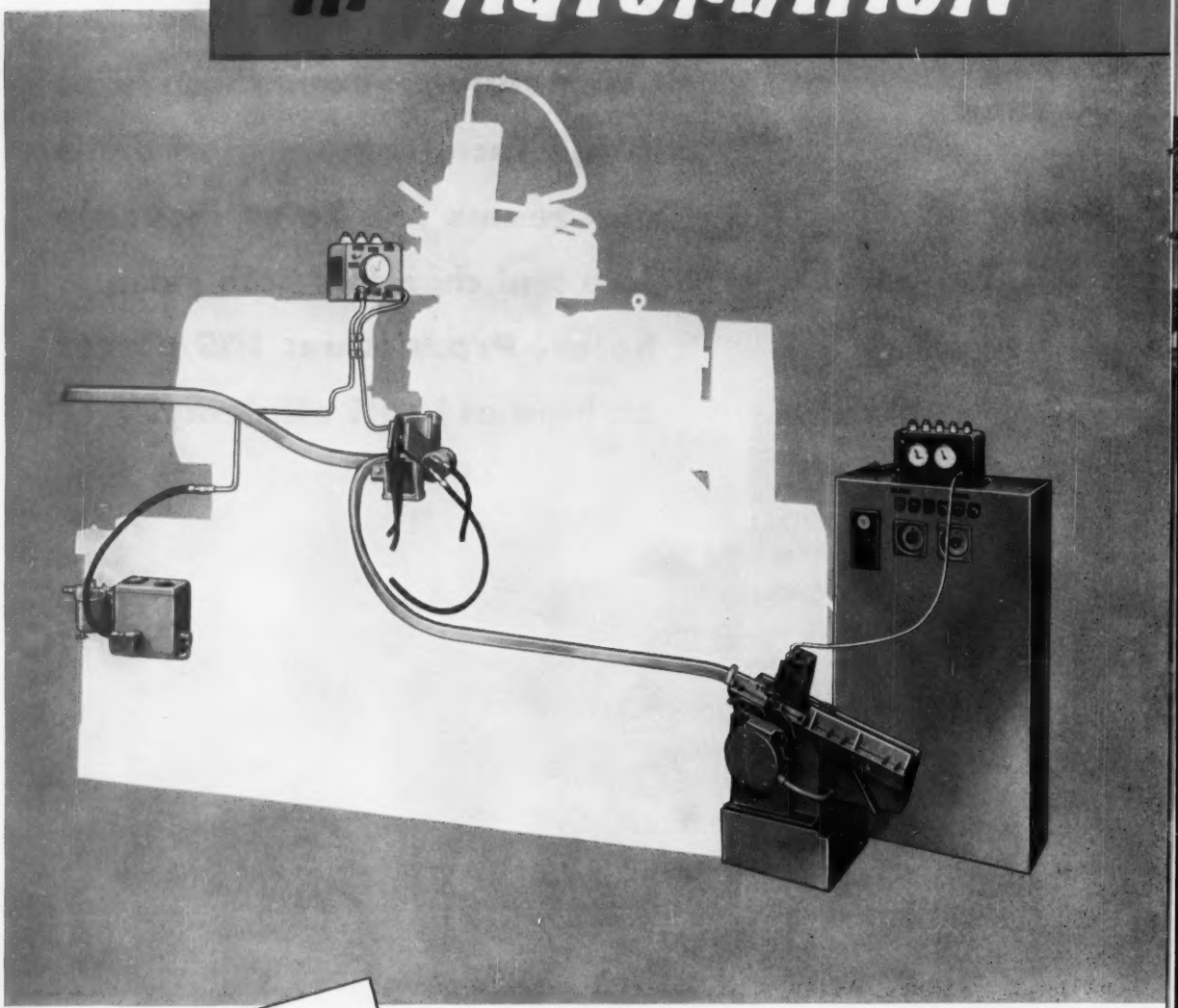
SNYDER

TOOL & ENGINEERING COMPANY

3400 E. LAFAYETTE • DETROIT 7, MICHIGAN

31 Years of Special Machine Tools with Automation

In AUTOMATION



Federal's Solution to the Cost of Gaging . . .
Impartial Gage Selection
Engineering Follow-Through
Everything in Gages

Combined Gaging permits close control of work size over long periods of time. To compensate for drift, etc., gage on the machine shifts its control point at the command of the after-gage (lower right) which originates signal when a prescribed number of pieces has exceeded marginal limits.

Ask **FEDERAL** *First*

FOR RECOMMENDATIONS IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automation Gaging

Gaging, too, FEDERAL goes the whole way

If you're ready to talk about . . .

Control on the Machine
Control after the Machine
Combined Gaging
Control for Non-Reference Variation
Control of Size for Predetermined Fit
Continuous Process Control
Control Point Compensation
Flagging Gages
Chute Gages

or other types and methods of automation gaging—

Automation has become a byword in plants today. It's easy to look upon Automation as the answer to every production problem. Being the first to treat Automatic Gaging so fully, however, we are well aware how helpful experienced advice can be in avoiding the mistakes and disappointments which often occur when complete automation is undertaken with *insufficient knowledge and too hasty planning.*

Close cooperation with machine tool builders has enabled us to successfully develop gages that conform to the capabilities of their machines. Our engineers provide various degrees of control on existing machines in the field and also work in close collaboration with machine designers to provide gaging and control units built into the manufacturer's original machines.

Many highly successful installations in daily operation demonstrate our practical knowledge in this field of gaging. We will welcome the opportunity to discuss your proposed automation when you first start your preliminary planning.

Our goal is the development of the one best automation gage for your job using mechanical, air, electric, or electronic gaging systems, whichever suits your needs best. Write or call us today.

Federal Products Corporation
6118 Eddy Street, Providence 1, R. I.

NEW

AUTOMATION CATALOG 56 AM

Includes many photographs and diagrams showing automatic gaging systems successfully employed in various industries. Full of valuable ideas — an important reference book.

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Send Automation Catalog 56 AM

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Company Name.....

Address.....

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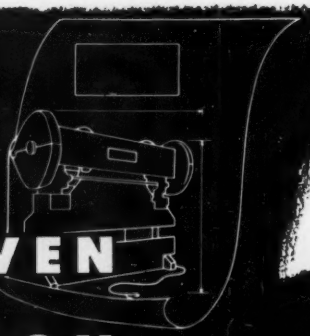
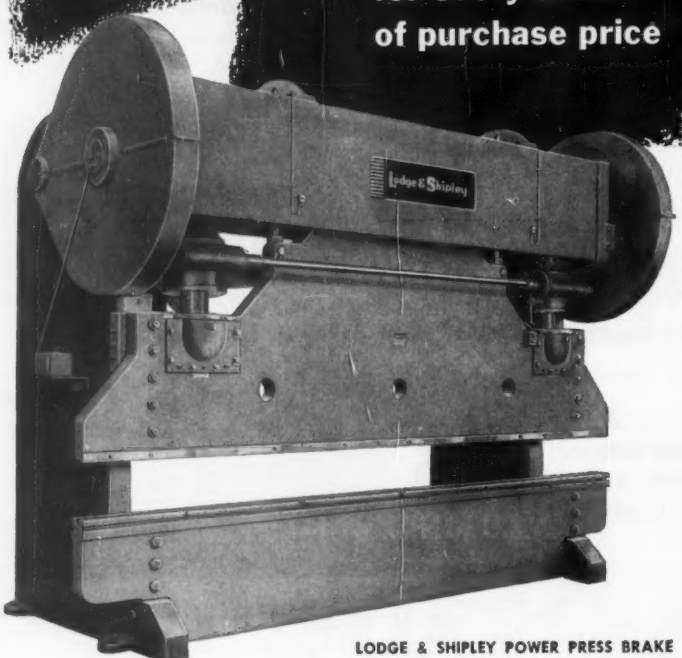


PROVEN DESIGN PLUS LODGE & SHIPLEY "KNOW HOW"

gives you a better brake for every dollar of purchase price



LODGE & SHIPLEY POWER PRESS BRAKE
Series 350 Capacities from 8' x 5/8" to 20' x 1/4"

From a background of more than 100 years of experience in building heavy metalworking equipment, Lodge & Shipley is producing power press brakes equal or superior to any other.

Built to Lodge & Shipley standards of strength and accuracy, for long service and minimum maintenance, these power press brakes offer many features which contribute to cost savings.

For example, the air clutch and spring brake is specifically designed for press brake service. The smoothly operating positive clutch is installed in a heavy, balanced flywheel. When the clutch is disengaged, the disc-type friction brake is automatically applied, positively holds **the ram in any position.**

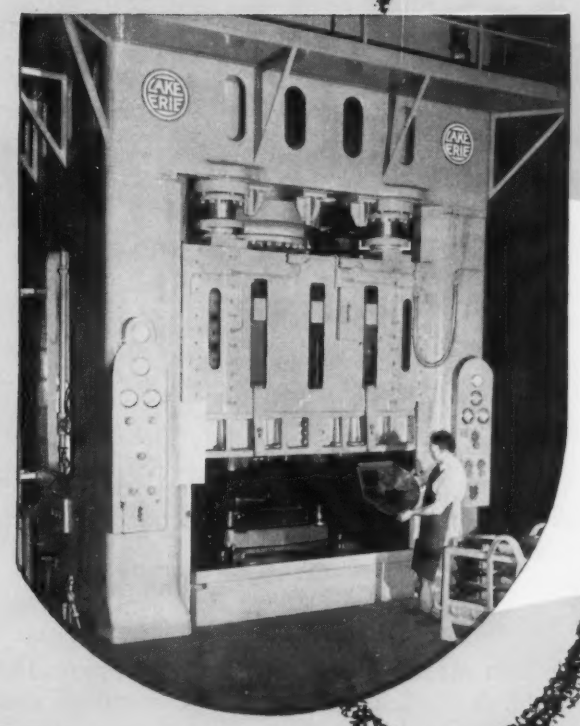
Give yourself a *better brake,* check the many features of Lodge & Shipley power press brakes against any other power press brake . . . then make your decision.

Write for FREE Bulletin PB-4 and the name of your nearest distributor.

THE Lodge & Shipley COMPANY
3057 COLERAIN AVE., • CINCINNATI 25, OHIO

REPEAT ORDERS TELL THE STORY

of Customer Satisfaction with Lake Erie



One of the many different types and sizes of Lake Erie presses serving Caterpillar Tractor Co. is this 2,000 ton double action, side housing design with cushion. This press has a 42" draw stroke, 24" clamp stroke, 96" x 96" bed, closing and return speed of 430"/min., and pressing speed of 23"/min.

CATERPILLAR TRACTOR CO.

has re-ordered Lake Erie presses more than **20 TIMES**

Caterpillar Tractor Co. placed its first order for a hydraulic press in 1947. Today, some of the most important production operations in Caterpillar's plants are performed on Lake Erie presses. These operations include drawing, blanking, hot forming, bending, bulldozing and others. Like Caterpillar Tractor Co., many other of the great names in American industry use Lake Erie presses for a multiplicity of production jobs.

LAKE ERIE
ENGINEERING CORP.
BUFFALO, N.Y. U.S.A.

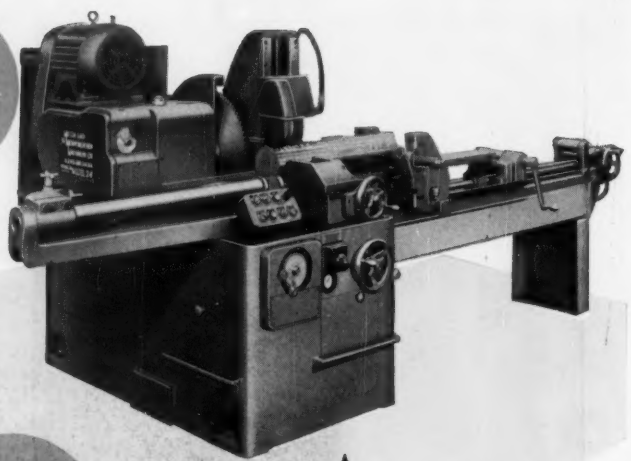
LAKE ERIE ENGINEERING CORP.

General Offices and Plant: 470 Woodward Ave., Buffalo 17, N.Y.
District Offices in New York, Chicago, Detroit, Pittsburgh
Representatives in other U. S. Cities and Foreign Countries

LAKE ERIE® ● **Manufacturers of die casting machines and the most complete line of hydraulic presses for all industry.**

THE Triple-Chip METHOD IS A Triple-threat TO HIGH CUTTING COSTS

CIRCULAR SAWING MACHINES

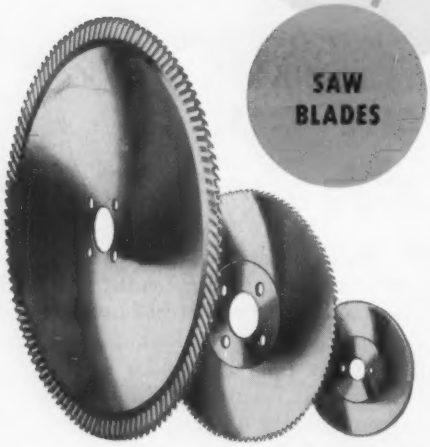


The No. 2-8 machine for cutting off solid metal up to 8" square.

SAW BLADE SHARPENERS

The G-45 sharpener for blades 8" through 48" diameter.

SAW BLADES



M. & M. saw blades cut any machinable metal. Cut-off blades: segmental — 11" through 120" diameter; solid — 8" through 20" diameter. Slitting saws — 3" through 8" diameter.

You may profit immensely by applying the M. & M. Triple Threat to *your* cut-off costs. Machine, blade, and grinder, made by the first company to build all 3, often effect phenomenal savings, as proved by detailed case studies. *Just such a study of your job is yours for the asking.* We offer you an unmatched experience in the sawing of any machinable metal, round, square or structural shapes, from 1/4" through 43" diameter.

THE MOTCH & MERRYWEATHER MACHINERY CO.

MACHINERY MANUFACTURING DIVISION

CLEVELAND 13, OHIO

Builders also of Production Milling, Vertical Turning, Automatic and Special Machines

Joe Doesit, Machine Operator, says:

"I LIKE MY GEOMETRIC DIE HEADS because...

...they never let me down. You see, I'm on piece work and if one of these Die Heads acted up, it would mean the same as a cut in pay. But you can always count on a GEOMETRIC Head to stand the gaff. They're plenty rugged. I like the quick way you can change chasers, too."

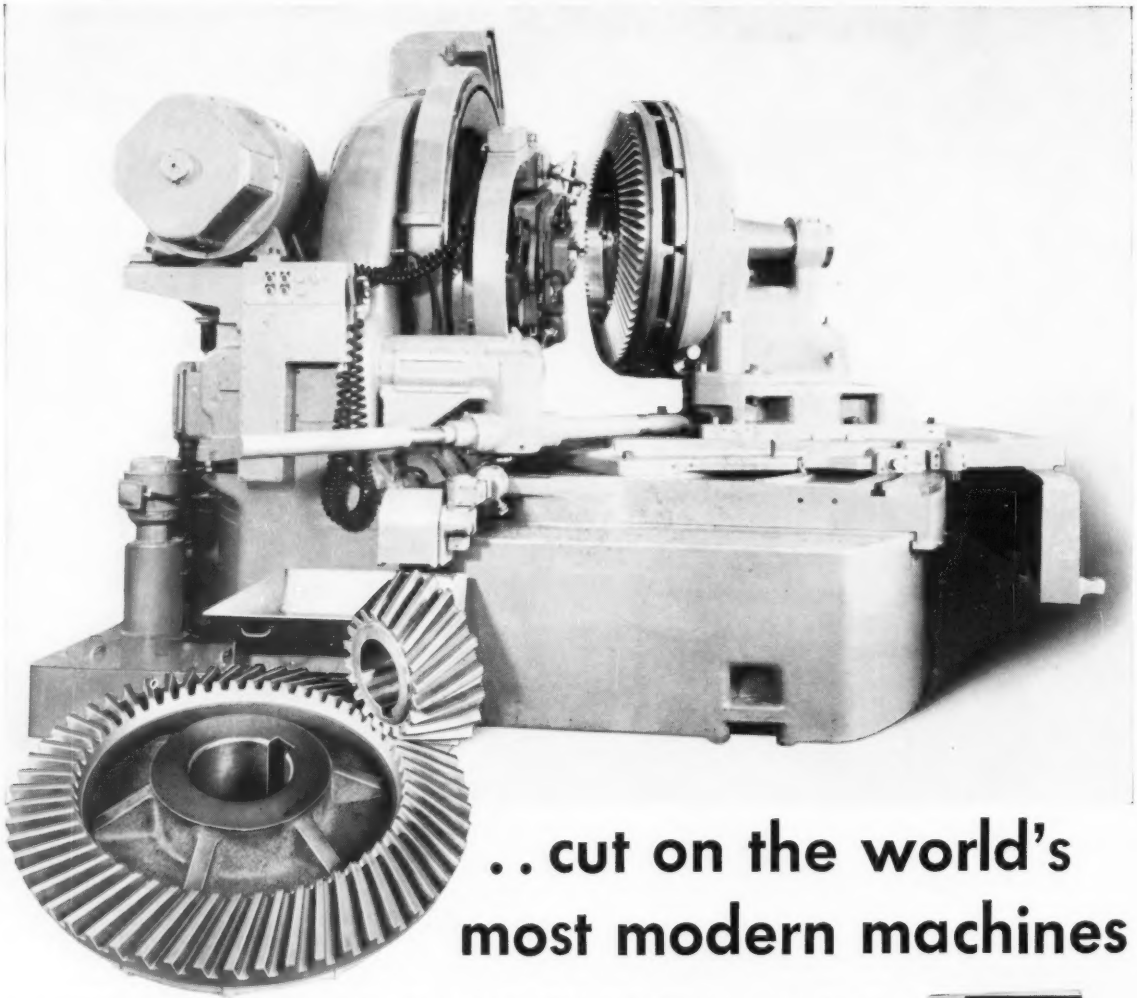
Greenfield Tap and Die Corporation

GEOMETRIC TOOL COMPANY DIVISION

New Haven 15, Connecticut

GEO MET RIC

NOW spiral-bevels up to 72" diameter, 10" face width



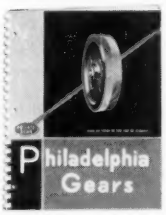
. . cut on the world's most modern machines

Our addition of a new 72" Generator assures the widest possible selection of Spiral-Bevel Gear diameters and face widths available anywhere—diameters up to 72"; face widths to 10". Even in these massive sizes, accuracy of tooth shape, and precision of gear and pinion operation are assured.

Acquisition of this modern, new machine is another step in keeping Phillie Gear one of the world's best equipped, largest and most progressive gear manufacturing plants.

Regardless of the type, size or quantity of gears needed, you are assured of Quality, Service, Delivery and Courtesy, when you call upon Phillie Gear—world leader in gear manufacturing—with nearly 65 years experience.

Send for our new 76-page Gear Book, on your Business Letterhead.



phillie gear®

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INDUSTRIAL GEARS & SPEED REDUCERS • LIMITORQUE VALVE CONTROLS • FLUID AGITATORS • FLEXIBLE COUPLINGS
Virginia Gear & Machine Corp. • Lynchburg, Va.

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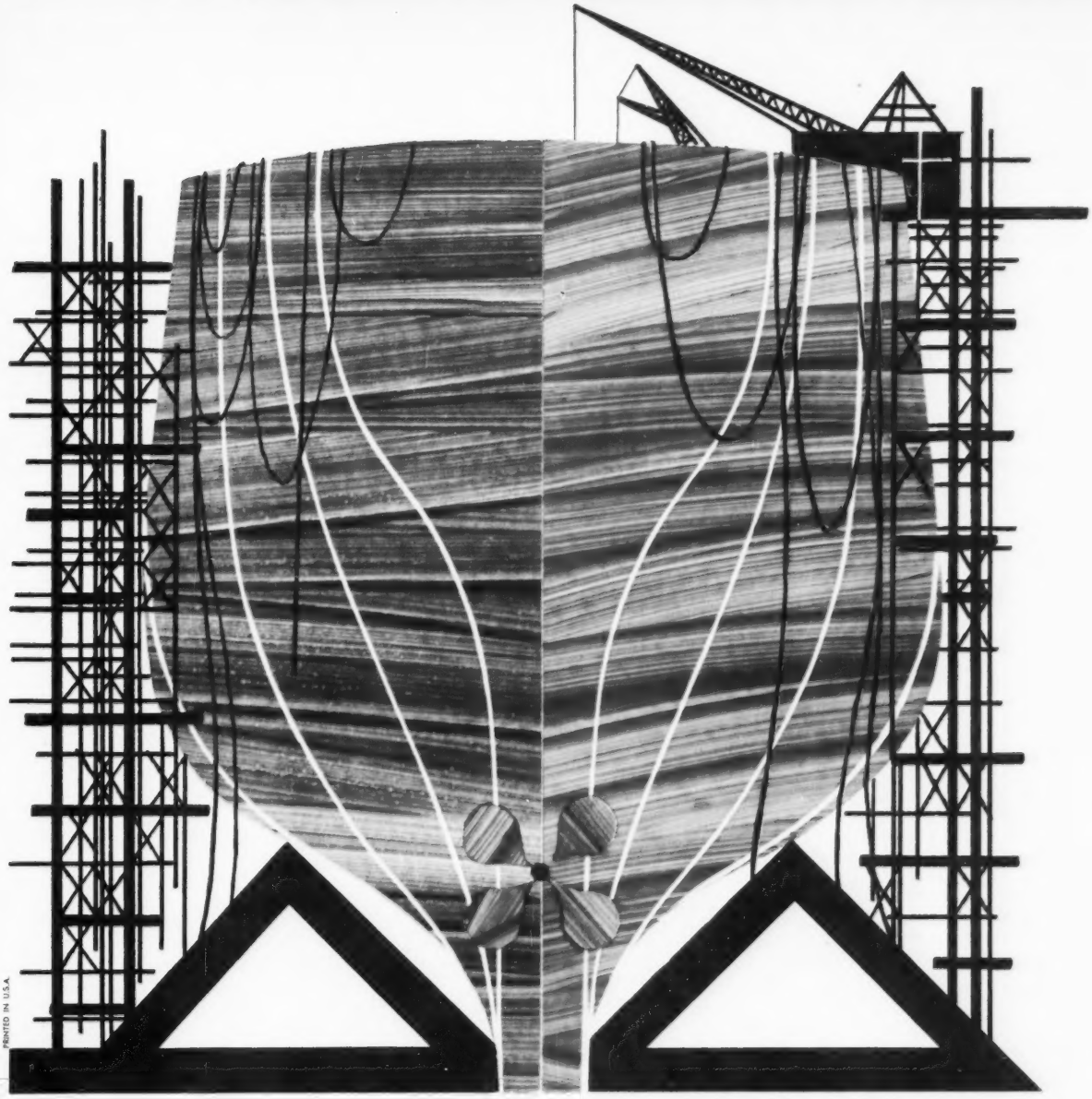

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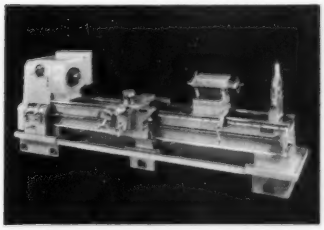
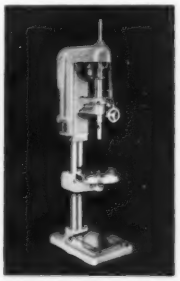




Machines shown are Cincinnati's new 21" Stationary Head Drill and 26" Tray-Top Lathe.

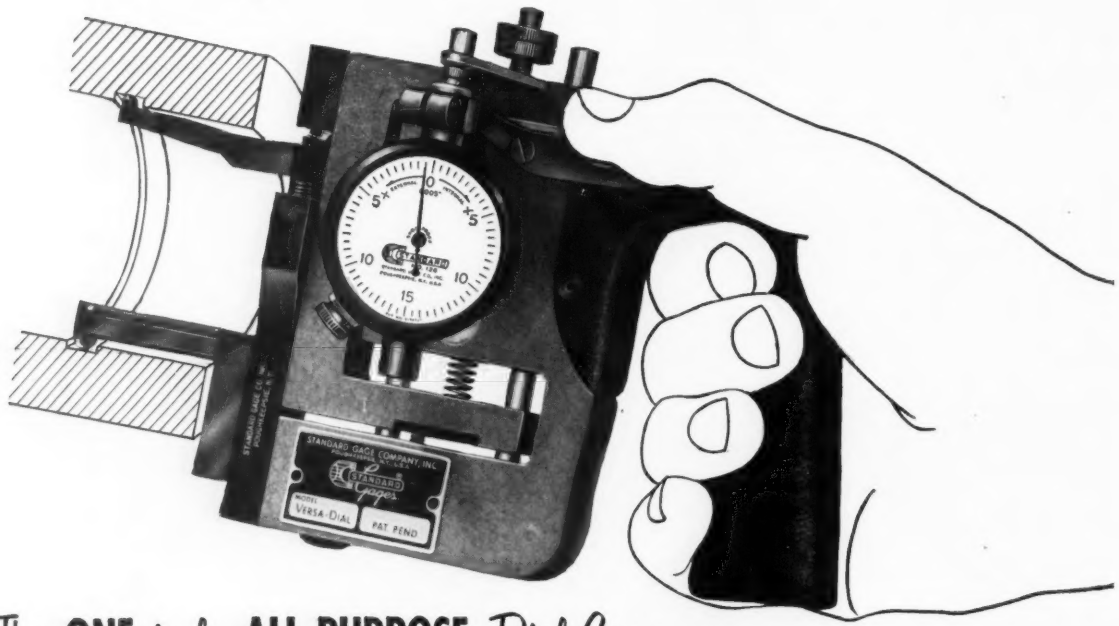
SHIPBUILDERS and ORDNANCE manufacturers are dynamically attacking "old age" among their 43,000 drilling machines and 55,000 lathes.* They recognize the problems of forging the arms of preparedness with half their machine tools of World War II vintage. This is the picture of *all* our country's production. It comforts the forces that would destroy us. It pleases your competition. Yet modernization is quick and inexpensive with "Standard Machine Tools" developed against fresh, new concepts of appearance, function and accuracy. To this end, Cincinnati Lathes and Drills are built to do much of your jobbing, tooling, maintenance and light production work at tremendous savings. Write for complete catalog information. Cincinnati Lathe and Tool Co., 3247 Disney, Cincinnati 9, Ohio.

*Figures from American Machinist's Seventh Inventory.

--⊕-- *center on...* **cincinnati lathes and drills**

Easy to Operate
Easy to Read

STANDARD® Versa-Dial®



The **ONE** truly **ALL-PURPOSE** Dial Gage

This Versa-Dial is fitted with fingers to measure I.D. of grooves. Other fingers are stocked for various lengths of reach and for small I.D's. Contact tips can be finished for O-rings, snap rings or specials, as required.

Equipped with other kinds of fingers, Versa-Dial can check your internal or external THREADS for assembly quality, shallow COUNTERBORES for I.D., GEARS for pitch diameter, DOVETAILS and a host of SPECIAL SHAPES.

Write for details and prices to meet your specific needs

STANDARD GAGE COMPANY, INC.

MEASURING INSTRUMENTS FOR PRECISION INDUSTRY

122 PARKER AVE. **POUGHKEEPSIE, N. Y.**

STANDARD® Gages

For more information fill in page number on Inquiry Card, on page 241

the Opportunities of Obsolescence by

H. L. HOEFMAN
Vice-President for Manufacture
LINK-BELT COMPANY

THERE are two principal reasons for replacing industrial equipment: obsolescence and general deterioration. We much prefer to replace equipment because of obsolescence, since this means that we have found a better, quicker, or cheaper method of manufacture. With techniques changing as rapidly as in this day of great technological advancement, it is usually unprofitable to keep a machine until general deterioration requires its replacement with a similar unit.

"Therefore, we place first emphasis on the *method* of doing any given job. We are constantly urging the manufacturing heads of our various plants to be alert to all suggestions and ideas for new and better methods, regardless of how effective the present process may appear. Without this approach it is easy to fall into a practice of merely buying a new model of an old machine.

"So far as replacement for deterioration is concerned, accurate records are kept of maintenance costs on present equipment, and careful checks made on quality and quantity of work turned out.

"The MAPI method of equipment analysis provides Link-Belt an accurate measuring tool in determining time for replacement, either because of obsolescence or deterioration, and we use it in connection with the purchase of all equipment.

"As manufacturers of capital equipment, we follow the same line of thinking in both our development and sales work, attempting to work out for our customers complete new methods and processes for reducing costs, easing back-breaking labor and providing greater safety for workers through the use of conveying, processing and power transmission machinery."

ROCKFORD
INSERT
GROUP

Keep gathering metal-working production ideas . . . be well informed when you replace machinery . . . . .

August, 1956

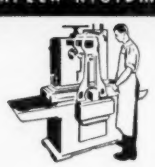
This Sundstrand Automatic Lathe Increased Production 3 Times

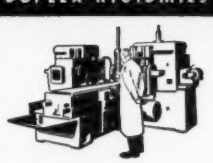
Here's a Sundstrand Model 16 Automatic Lathe that increased production of inner and outer bearing races an average of three times compared to the previous method of machining.

Parts range in size from 9½" to 23⅜" outside diameter and lot sizes vary from 100 to 1000 pieces.

Even though the lot sizes are relatively small the quick set-up and many other features of the Sundstrand Automatic Lathes make it possible to obtain savings like these.

AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS





SUNDSTRAND "Engineered Production" Service*
*REG. U.S. PAT. OFF.

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

WHY SUNDSTRAND CAN OFFER ECONOMICAL SOLUTIONS TO PRACTICALLY ANY TURNING JOB

Many years of designing machine features to increase production and lower costs on all classes of turning problems has provided Sundstrand with the experience to design and build equipment for practically any turning job. A few of the diversified types of Sundstrand tooling and equipment provided for different turning problems are shown on this page.

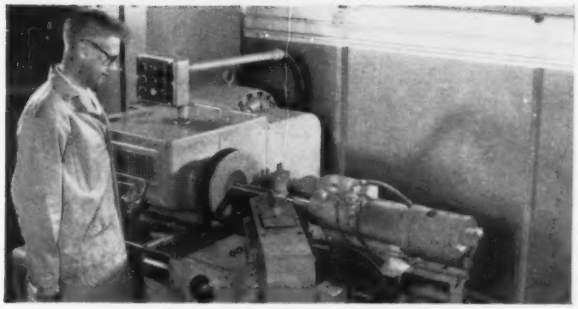
Automatic Tool Resetting

Self compensation for tool wear and automatic replacement of tools worn to a predetermined limit have been built into the Automatic Lathe shown above. Lathe can run approximately an 8 hour shift without attention, except for an occasional check by operator to make sure parts are being delivered to the loading mechanism.

Although the lathe shown above is for turning motor rotors the principle of automatic tool re-setting has been applied to Sundstrand Automatic Lathes for other types of jobs.

How to get the right machine for your work

Investigate the many services and physical equipment available from Sundstrand "Engineered Production." Call in a Sundstrand engineer, or write for bulletin 670. There is no obligation for this service.

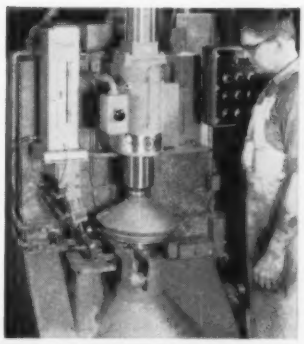


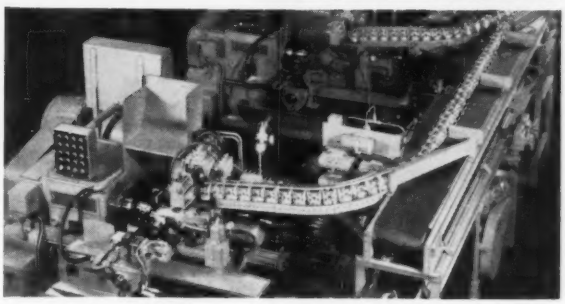
Tracer Turning

For multi-cycle single point turning of irregular shapes, Sundstrand Automatic Lathes can be provided with a template controlled tracing slide that replaces the regular front carriage. With this tracing slide and controls, ruff, semi-finish and finish cuts can be taken with one turning tool in an automatic cycle. The regular rear slide can be used to square up shoulders, chamfer, etc.

Vertical Turning

Here's the Sundstrand Vertical Lathe of a simplified basic design easily adapted to production work. Shown here, it bores, polishes and gages the ID of brake drums. Machine is easily arranged for turning, grooving, or tracer applications.

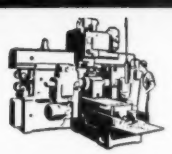


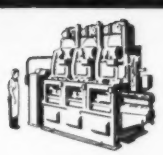


Automatic Loading

Here's one of the many automatic loading and unloading units designed for Sundstrand Automatic Lathes to handle a specific part. Units of this type simplify machine operation and provide a complete automatic cycle for high production.

TRIPLEX RIGIDMILS | SPECIAL MACHINES



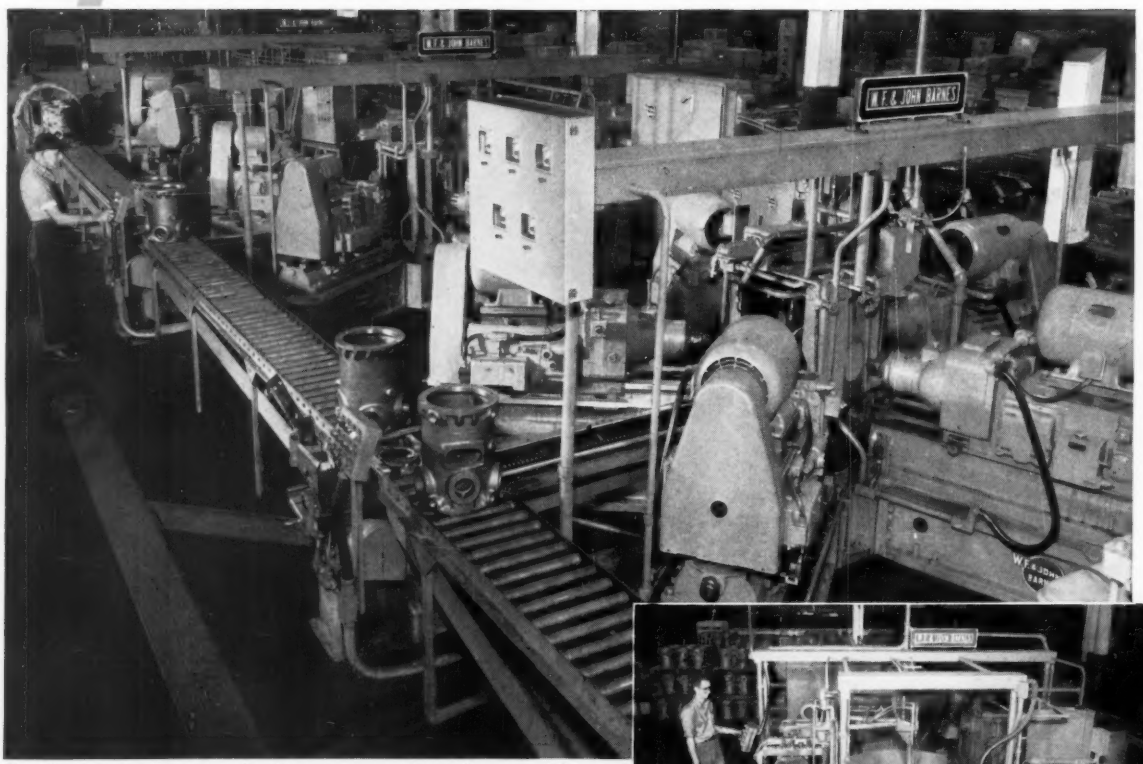


SUNDSTRAND
Machine Tool Co.
2530 Eleventh St. • Rockford, Ill., U.S.A.

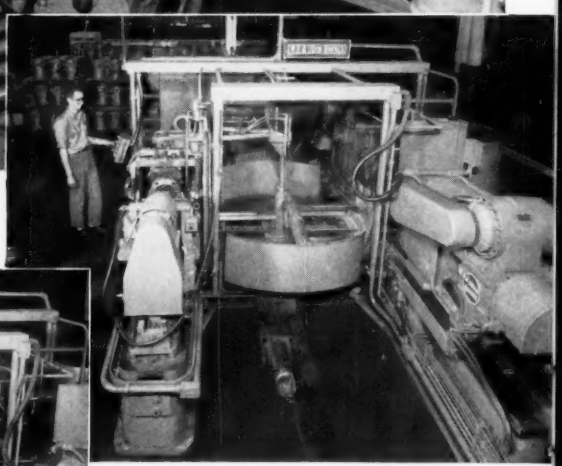
CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

HOW W. F. & JOHN BARNES

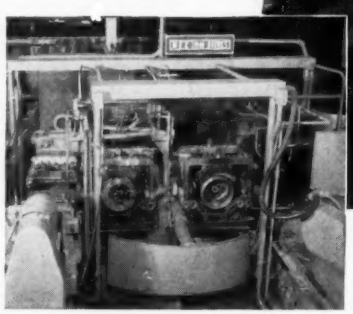
"Specials" Cut Costs on



Overall view of three 5-Way Machines. First machine in foreground, bores and faces 5 flange holes; second, performs 8 combination drilling and chamfering operations; third, handles 14 tapping operations. All three machines are equipped with power transfer from gravity conveyor. One operator loads and unloads three machines at pushbutton stations.



View showing workpieces in center turntable after 180° turn, ready for traversing into new machining position. Machining cycle at station 2 allows operator time for unloading and loading at station 1 without losing production time.



4-Way Machine with reciprocating index fixture. Left-hand two-spindle heads drill and finish-ream .750" dowel holes in both ends. Right-hand single stub-spindle heads bore, chamfer and face stator and cylinder ends.

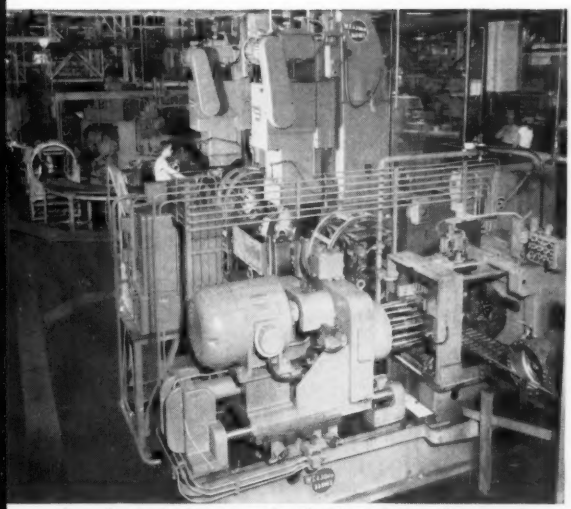
W. F. & JOHN BARNES

BUILDERS OF BETTER MACHINES SINCE 1872

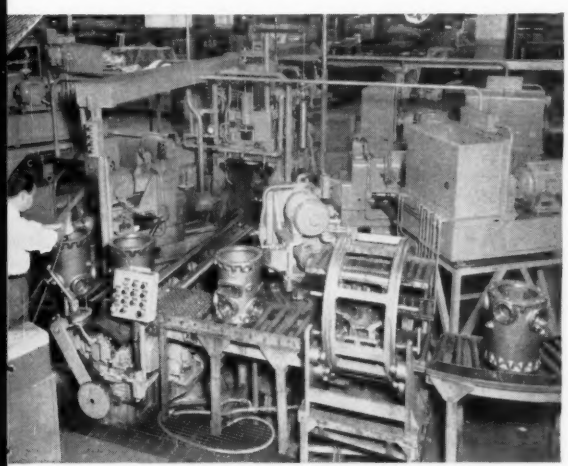
MULTIPLE SPINDLE DRILLING · BORING · TAPPING

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

Low Production Work



Overall view looking toward end of line. Unit in foreground taps 31 holes in ends of piece and presses in two center bushings. Vertical machines are facing units for machining stator end and hub, and cylinder end and hub.



View of 6-Way Boring Machine for finishing five cylinder bores and two babbited bushings. Concentricity of stator and crankshaft bores is held to max. of .005" T.I.R. Babbit chips are collected in separate chip box. C.I. chips for entire line are flushed automatically to a central system.

MULTI-STATION UNITS REDUCE MACHINING TIME ON COMPRESSOR CRANKCASES 1.85 HRS. PER PIECE

At Airtemp Division, Chrysler Corporation, Dayton, Ohio, a battery of ten Barnes Multiple Spindle Machines are today demonstrating the efficiency and economy of special machines engineered to serve relatively low production requirements. Previously, the compressor crankcases used in Airtemp's fine line of large 5-cylinder commercial air conditioning units were drilled, milled, bored, faced, and tapped in single operation machines. Now, most of these operations are performed automatically in Barnes specials. As a result, machining and handling time has been reduced 1.85 Hrs. per case. In addition, close tolerances are more easily maintained which has increased product quality.

PRODUCTION GEARED TO 15 CRANKCASES PER HOUR

The Barnes Multiple-Spindle Specials are incorporated into a semi-automatic production line which is geared to produce 15 crankcases per hour. Parts are moved between machines on gravity conveyors, and operators manually position workpieces into the loading station of each machine. Powered turnover and transfer devices are included to minimize manual effort. After more than 12 months of operation, the new line has effected savings equalling the preliminary estimates of Airtemp Engineers, and at the same time has provided the additional capacity to meet an increased demand for their product with little increase in floor space.

INVESTIGATE BARNES SIX-POINT COORDINATED MACHINE BUILDING SERVICE

We suggest you investigate the profit possibility of applying Barnes special machines to your work. Find out, too, how Barnes six-point coordinated engineering and building services can help you eliminate divided responsibility and save time. Write for free brochure or ask for an analysis on any specific job.

W. F. & JOHN BARNES COMPANY

402 SOUTH WATER STREET · ROCKFORD, ILLINOIS

MACHINES · AUTOMATIC PROGRESS-THRU AND TRANSFER TYPE MACHINES

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

Duplication

Duplication

KOPY-KAT Duplication

is a direct hydraulic transfer with no intermediate motions

machining is completely automatic

there is no chance for irregularities or error in final work

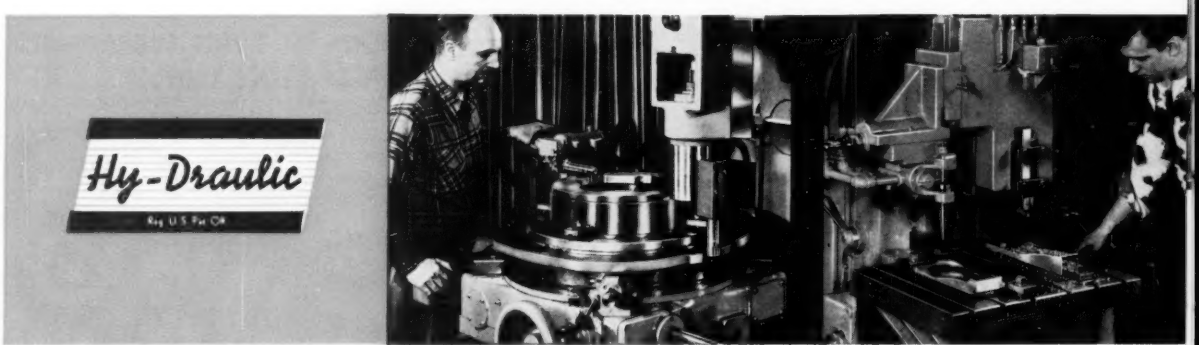
The KOPY-KAT is adaptable to an endless variety of duplicating jobs, from the simplest to the most complex. Manufactured specifically by Rockford Machine Tool Co. for use on new machines, it becomes an integral operating part of any hydraulic shaper, planer or slotter on which it is installed.

Investigate the KOPY-KAT which duplicates automatically with the ease of straight-production machining . . . and faithfully reproduces many forms previously considered impossible to machine.

Ask a Rockford Machine Tool Co. representative for further information . . . or write directly to us.

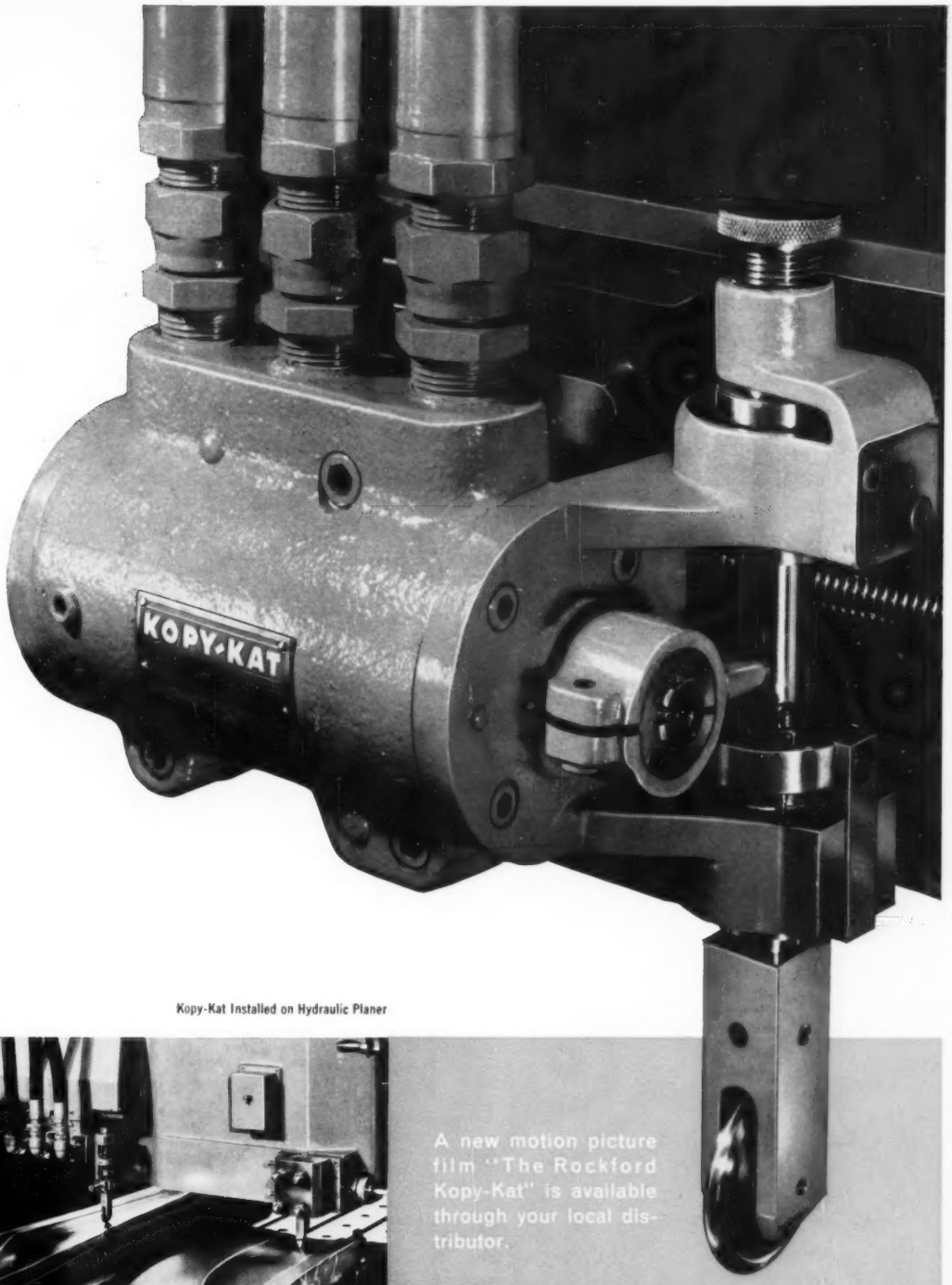
Kopy-Kat Installed on Hydraulic Slotter

Kopy-Kat Installed on Hydraulic Ram Shaper

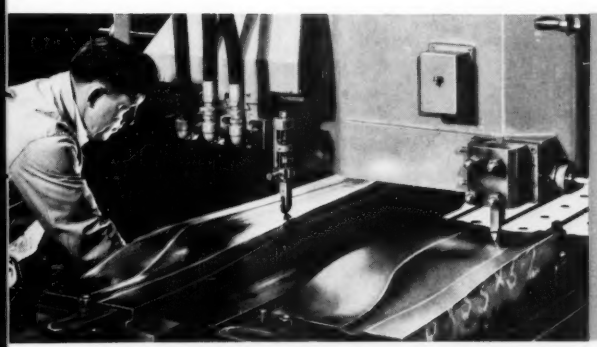


SHAPERS · PLANERS · SLOTTERS · SHAPER-PLANERS · LATHES

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**



Kopy-Kat Installed on Hydraulic Planer



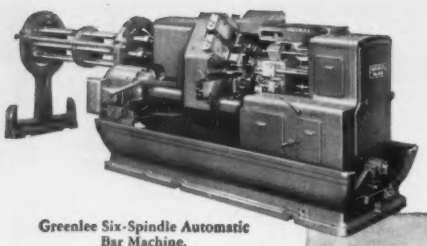
A new motion picture film "The Rockford Kopy-Kat" is available through your local distributor.

ROCKFORD MACHINE TOOL CO. ROCKFORD, ILLINOIS

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

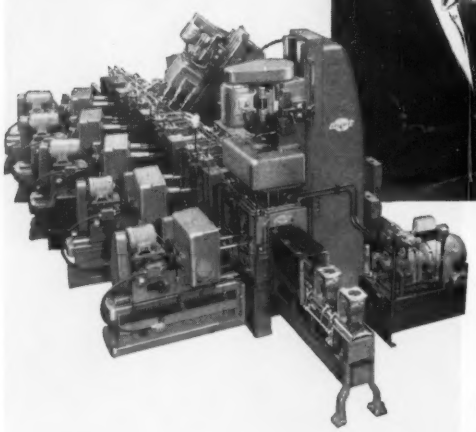
GREENLEE OFFERS

A PROFIT-MAKING INVESTMENT IN HIGH-PRODUCTION MACHINE TOOLS



Greenlee Six-Spindle Automatic Bar Machine.

Greenlee 22-Station Automatic Transfer Machine for machining transmission cases.



Greenlee creative thinking, Greenlee engineering and Greenlee experience combined with that of your own engineers will help you "produce more at lower cost."

Ideas, engineering, experience and facilities of Greenlee Bros. & Co. develop improved methods and machines for greater and greater productivity of future models.

Greenlee's adequate facilities expedite the transition from production ideas to production machines . . . a profit-making investment at work in your plant.

Greenlee 10-Station Automatic Transfer Machine.

GREENLEE STANDARD AND SPECIAL MACHINE TOOLS

- Multiple-Spindle Drilling and Tapping Machines
- Transfer-Type Processing Machines
- Six and Four-Spindle Automatic Bar Machines
- Hydro-Borer Precision Boring Machines

Write for Further Information

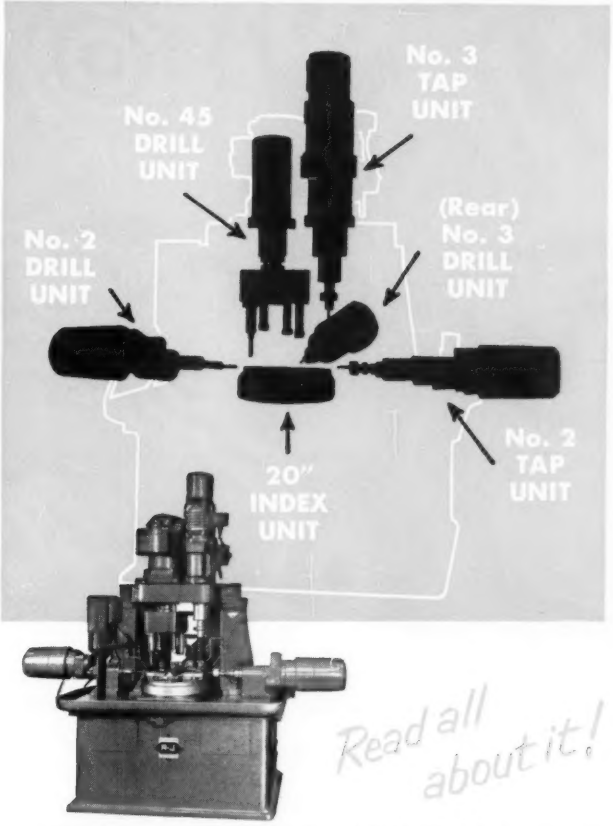
GREENLEE

GREENLEE BROS. & CO.
1870 Mason Avenue
Rockford, Illinois

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

REHNBERG-JACOBSON

DRILL, TAP, AND INDEX UNITS MAKE VERSATILE MACHINES



Here's an example of how it is done

At the left you can see how several different R-J ALL-MECHANICAL Drill, Tap, and Index Units have been mounted on a base-and-column structure to produce a complete automatic production machine tool. Each of the several types of units is made in a range of sizes, sufficient to cover the great majority of ordinary machining operations. The units are easy to mount and can be arranged horizontally, vertically, or at any angle as desired. The machine shown, for example, drills, taps, faces, counterbores, and performs a simple serration operation on a steel forging. If a design change in the piece should occur, the machine can be easily and quickly altered to handle any new requirements. *R-J Units are all available separately, so YOU can assemble or modify your own production machines.*

Read all about it!

The whole story of R-J ALL-MECHANICAL Units is presented in full detail in this handsome and useful 43-page book — which is available FREE on request. Here you will find individual and fully-detailed specification sheets on all types and sizes of R-J ALL-MECHANICAL Drill, Tap, and Index Units. From this information, you can see exactly how any unit will fit any contemplated machine, and the capacity it has for handling various operations. In addition, basic wiring diagrams are furnished for all units, including interconnections for automatic sequence operations. Finally, the book contains a score of outstanding examples of production machines that have been designed and built by Rehnberg-Jacobson, showing many practical ways in which R-J ALL-MECHANICAL Units have been successfully used.

SEND FOR THIS FREE BOOK!

ALL UNITS AVAILABLE for PROMPT DELIVERY

REHNBERG-JACOBSON MANUFACTURING CO. ROCKFORD, ILLINOIS

REHNBERG R-J JACOBSON

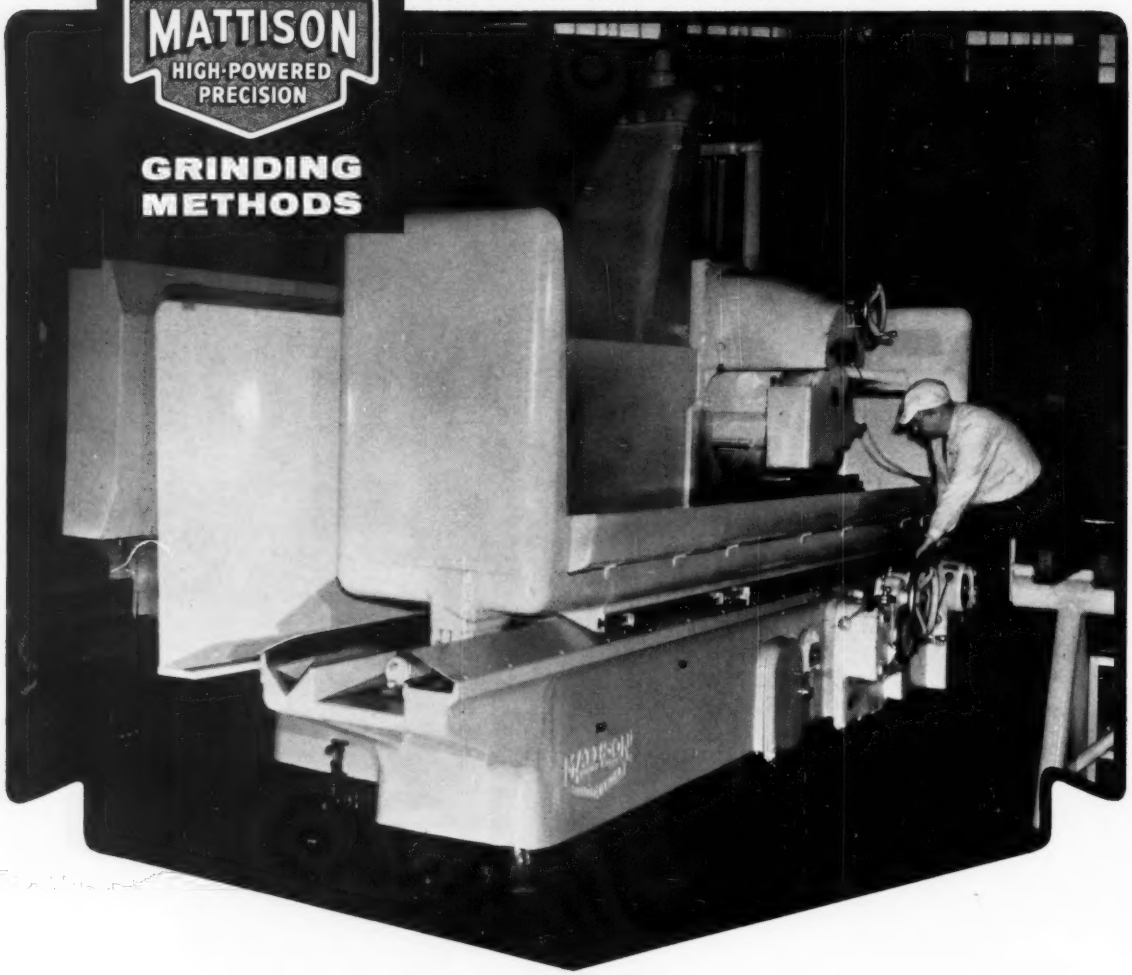
DESIGNERS, ENGINEERS MANUFACTURERS AND PRODUCTION CONSULTANTS

FOR PRODUCTION MACHINE TOOLS IT'S ROCKFORD, ILLINOIS, U.S.A.

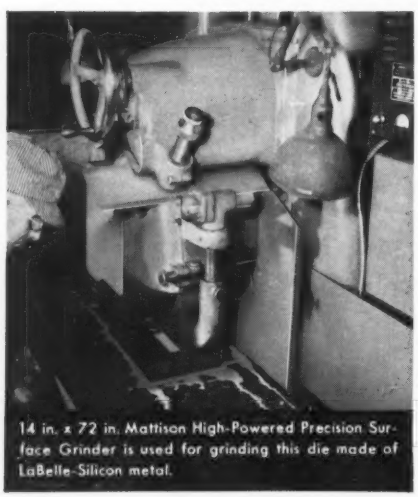
CASE HISTORY NO. 26—LOCOMOTIVE PARTS

MATTISON
HIGH-POWERED
PRECISION

GRINDING METHODS



Rapid stock removal and high precision...profitable combination for grinding locomotive parts!



14 in. x 72 in. Mattison High-Powered Precision Surface Grinder is used for grinding this die made of LaBelle-Silicon metal.

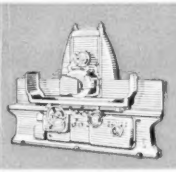
Mattison Surface Grinders are "standard equipment" in most railroad shops because they assure profitable machining of a variety of large and small parts.

In these installations, Mattison Grinders are used to machine inside and outside surfaces of multiple guards for steam locomotives, as well as for grinding guide bars, miscellaneous parts for diesel motors, shear blades, and hardened steel dies to close limits of accuracy.

No costly fixtures are needed. Stock is "hogged off" at surprising speed. And there's virtually no setup time between jobs.

The Mattison High-Powered Precision Surface Grinder gives you a highly versatile, cost-cutting method for machining flat surfaces, as well as for form-grinding irregular shapes. Ability to remove stock quickly is the result of sturdy double-column support and massive base construction. Castings are Meehanite, poured in Mattison's foundry, and have extremely close grain and uniform solidity throughout all cross sections. Superior vibration dampening properties of the Meehanite help give you that extra-fine finish to add new quality and saleability to your product. Write for Bulletin "HP."

IF IT'S A FLAT SURFACE THERE IS A MATTISON TO GRIND IT

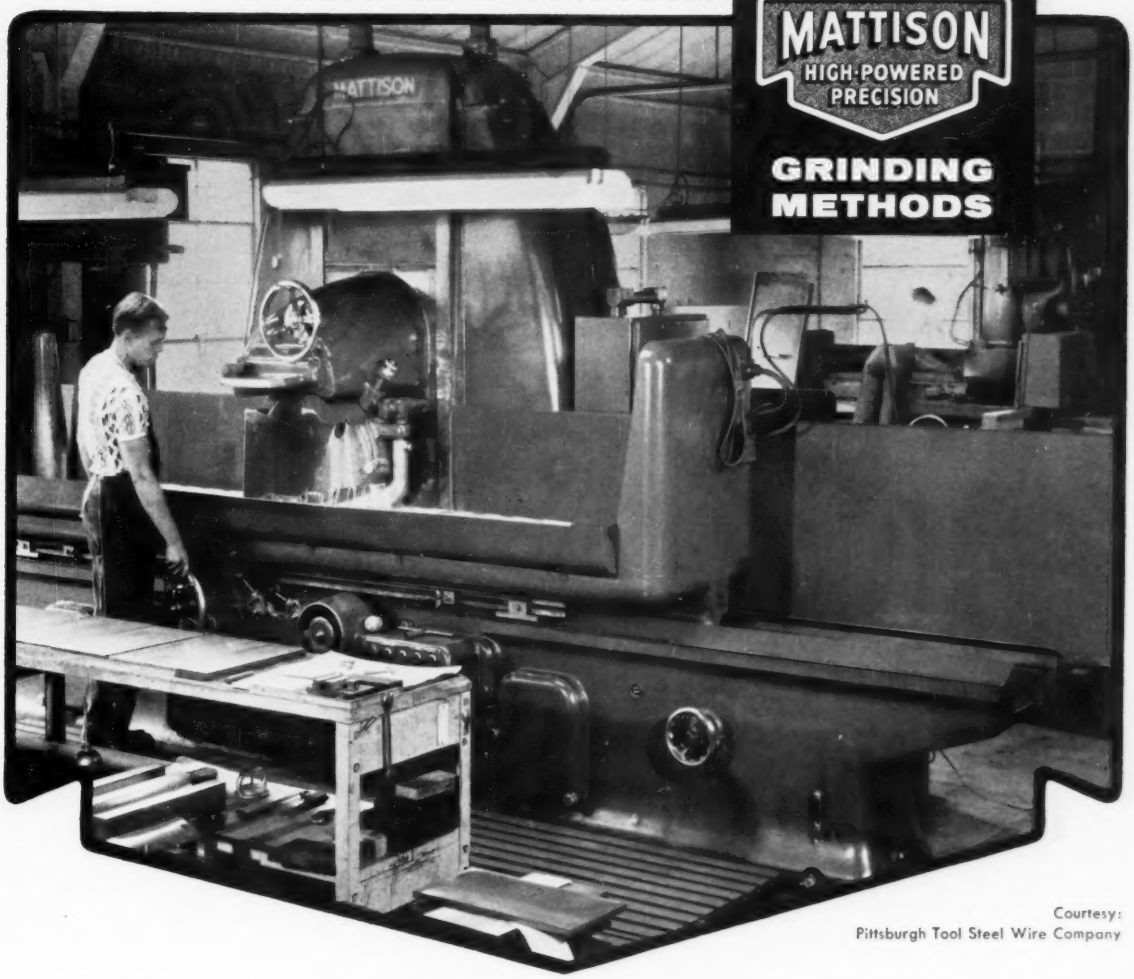


CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

CASE HISTORY NO. 27—GROUND FLAT STOCK

MATTISON
HIGH-POWERED PRECISION

GRINDING METHODS



Courtesy:
Pittsburgh Tool Steel Wire Company

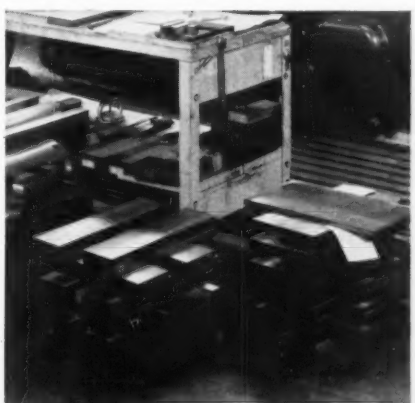
Holds thickness tolerance to limit of .0005 in. production-machining ground flat stock!

Many people still think of surface grinding as a toolroom, or finishing operation. But here's an example of how Mattison Surface Grinders are used on high-production jobs also.

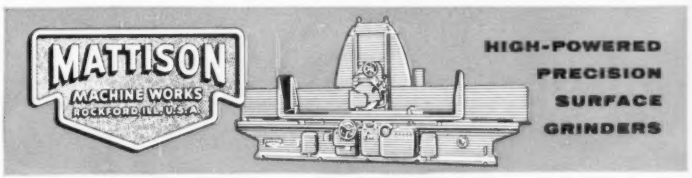
WARPLIS precision ground flat stock, used in the manufacture of dies and precision machinery, is ground to a standard thickness tolerance of plus or minus .001 in. But many special jobs require a total tolerance as close as .0005 in.

These tolerances are easy to hold on the "Mattison"—a machine that is built to handle a wide variety of large or small parts at stock removal rates you never thought possible on a surface grinder. Shoulder and edgework can be ground easily because of the machine's adequate wheel clearance and spindle construction. Interrupted surfaces are held to close tolerances because of its rigid spindle mounting.

You'll be surprised at the number of jobs in your shop you can do faster and better, once you install a "Mattison." Write for "Setups," a booklet describing the wide variety of jobs being ground in large and small shops throughout the country.

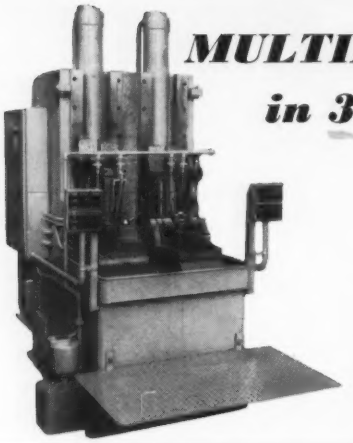


WARPLIS Precision Ground Flat Stock, from 1/64 in. x 1/2 in. up to and including 2 in. x 12 in. and 4 in. square, is processed on Mattison Grinders.

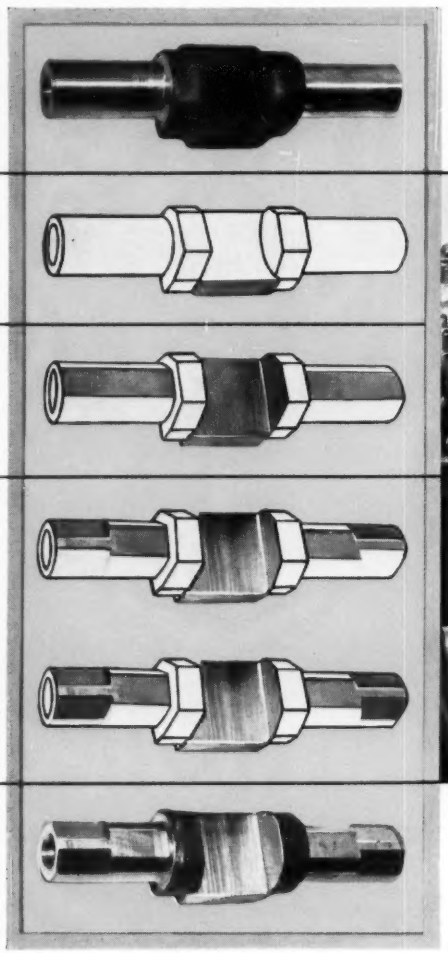


FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

MULTIPLE SURFACES BROACHED
in 3 operations on 1 machine!



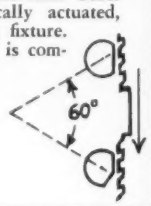
American TOOLING IS SIMPLE, EFFICIENT, ECONOMICAL

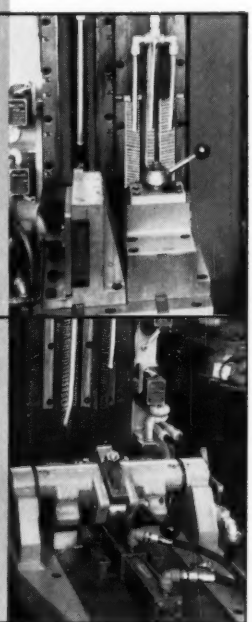


1- At the first of three stations on this American Dual Ram Broaching Machine, both sides of a pinion mate cross shaft are straddle broached to finished width. Sliding tables automatically move parts into broaching position and return for reloading.

2- Second station on the left hand ram moves part into position for simultaneous broaching of the sides and bottom of wide center slot and of the two flats on the O.D. of both ends of the shaft.

3- At the third station, two angular flats are broached on each end of the shaft in a single stroke of the right hand ram. Parts are clamped in a hydraulically actuated, trunnion type, work-holding fixture. As broaching of the first half is completed and a gap in the broaches is reached, fixture tilts automatically to position part for broaching the second flat.





Production:

OVER 170 PARTS PER HOUR
AT 100% EFFICIENCY

Here, a standard American broaching machine has been adapted, with relatively inexpensive tooling, to efficient, multiple operations that can be run on automatic or semi-automatic cycle. Versatility of the machine is unimpaired — it can be re-tooled easily for other purposes as later production requirements dictate.

American engineering can accomplish similar things for you. Whether your broaching needs call for relatively low cost tooling or for the highest degree of automation, American can best coordinate the design and building of the right machine, fixtures and broaches.

Write or 'phone details of your requirements. Or write for Catalog 450.

AMERICAN

American BROACH & MACHINE CO.

A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

American Building - Ann Arbor, Michigan

SUNDSTRAND

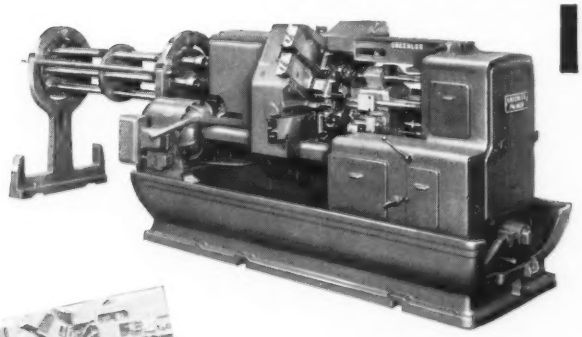
See American First — for the Best in Broaching Tools, Broaching Machines, Special Machinery

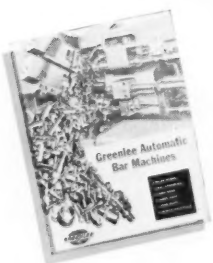
MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

1. Simplified cross-slide camming
2. Interchangeable cross-slide tool holders
3. Quick-adjusting stroke mechanism
4. Rapid speed and feed changes
5. Wide-open, easily reached tooling area
6. Built-in threading feed and drive
7. Easily accessible main toolslide holders
8. Stationary type collets changed quickly

eight big reasons why you get *Fast Setups* on GREENLEE BAR AUTOMATICS

In plant after plant countless hours of setup time are saved each year on Greenlee Bar Automatics. Similar savings in time and money can be achieved in your own plant. Greenlee has on-the-job case studies to prove it. Whether your responsibility lies in the field of management . . . production . . engineering . . . or purchasing you owe it to yourself and your company to call in the Greenlee man. Let him show you why and how faster setups on a Greenlee pay off in greater profits.





WRITE TODAY FOR CATALOG A-405

PRODUCTION MACHINERY GREENLEE

4-SPINDLE...6-SPINDLE
SECOND-OPERATION
PNEUMATIC STOCK FEED

PRODUCTION MACHINERY GREENLEE

GREENLEE BROS. & CO.
1871 Mason Avenue
Rockford, Illinois

FOR PRODUCTION MACHINE TOOLS IT'S ROCKFORD, ILLINOIS, U.S.A.

Something more

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

than craftsmanship

produces that built-in accuracy of a *Hendey* Tool and Gage-Makers' Lathe

The best is not good enough for Hendey craftsmen who produce machines like our 9 in. Tool and Gage-Makers' Lathe — machines that give you toolroom tolerances easily, with no "tricks" or time-consuming adjustments.

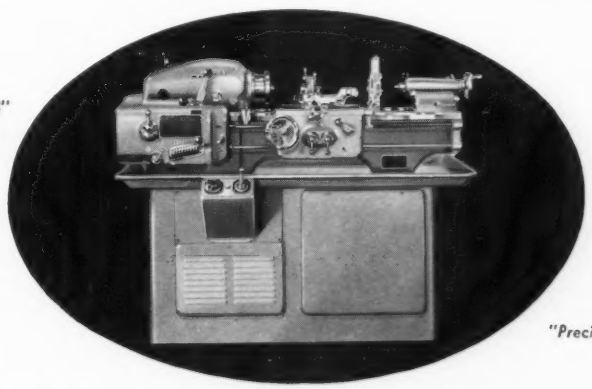
One of our men is grinding a spindle in the picture on the opposite page. It's the *care* he uses in determining wheel speed, feed, speed of work rotation, coolant flow, and wheel selection that makes the difference between a good spindle and a superior one. Experience tells him the proper relationship of these factors to the type of steel used in the spindle and the degree of hardness to which it has been processed.

Constant operating accuracy and maximum rigidity are assured because the spindle is mounted by other "craftsmen who care" in super-precision, antifriction bearings at both ends.

An electronically controlled drive is available for this 9 in. Tool and Gage-Makers' Lathe to give you quiet, infinitely variable spindle speeds from 15 to 3000 rpm. On facing cuts, stepped diameters, and tapers, you can change speeds during the cut by selecting the desired rpm on the control rheostat. Belt drive gives you smooth, vibration-free power to the spindle for fine finishes in the 25 to 3000 rpm range. Speed range from 15 to 250 rpm is achieved by back gears which operate at very low velocity.

When you're looking for the best in quality and quantity of toolroom output, look at this precision-built Hendey Tool and Gage-Makers' Lathe. Call your Hendey dealer for complete information about this machine.

Hendey 9" x 24" Tool and Gage-Makers' Lathe



"Precision with Production"

Hendey **machine division**

BARBER-COLMAN COMPANY

61 LOOMIS ST., ROCKFORD, ILLINOIS

BARBER COLMAN ®

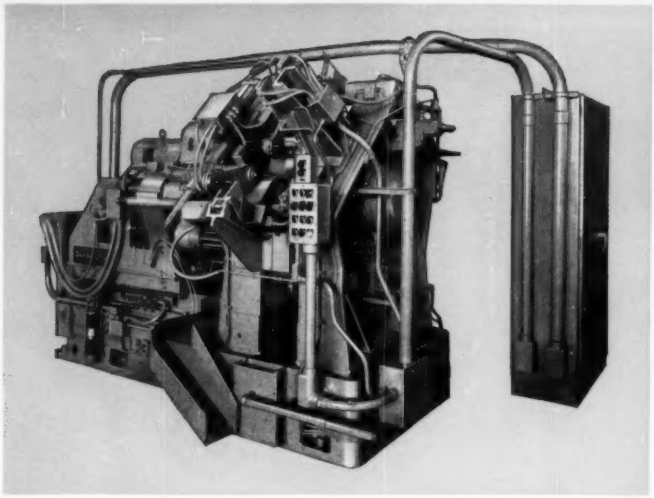
CITY OF MACHINE-TOOL SPECIALISTS ROCKFORD, ILLINOIS, U.S.A.

drilling

chamfering

reaming

tapping



FULLY AUTOMATED PRODUCTION

8000

operations per hour on BARNESDRIL special production machine

Maximum output with fully automatic production is obtained from this Special BarnesdriL Production Machine, due to continuous machining with no time necessary for operator actuation.

Gear blanks are fed by conveyor from automatic lathes to the loading station on the machine. Here a loading arm picks up each blank and the machine clamps it in the holding fixture. Blanks are drilled, chamfered, reamed and tapped on each of ten holes per blank, or a total of 8000 operations per hour. After drilling a probing unit automatically gauges holes for size. The machine after completing the cycle discharges blanks into a chute for conveyor removal. In case of inadequate depth of holes or broken tools, a warning signal appears and the machine stops automatically.

If you have parts requiring high speed automatic production, consult BarnesdriL engineers for estimates and production recommendations. Full range of cycle operations are available with cycle time engineered to meet production requirements.

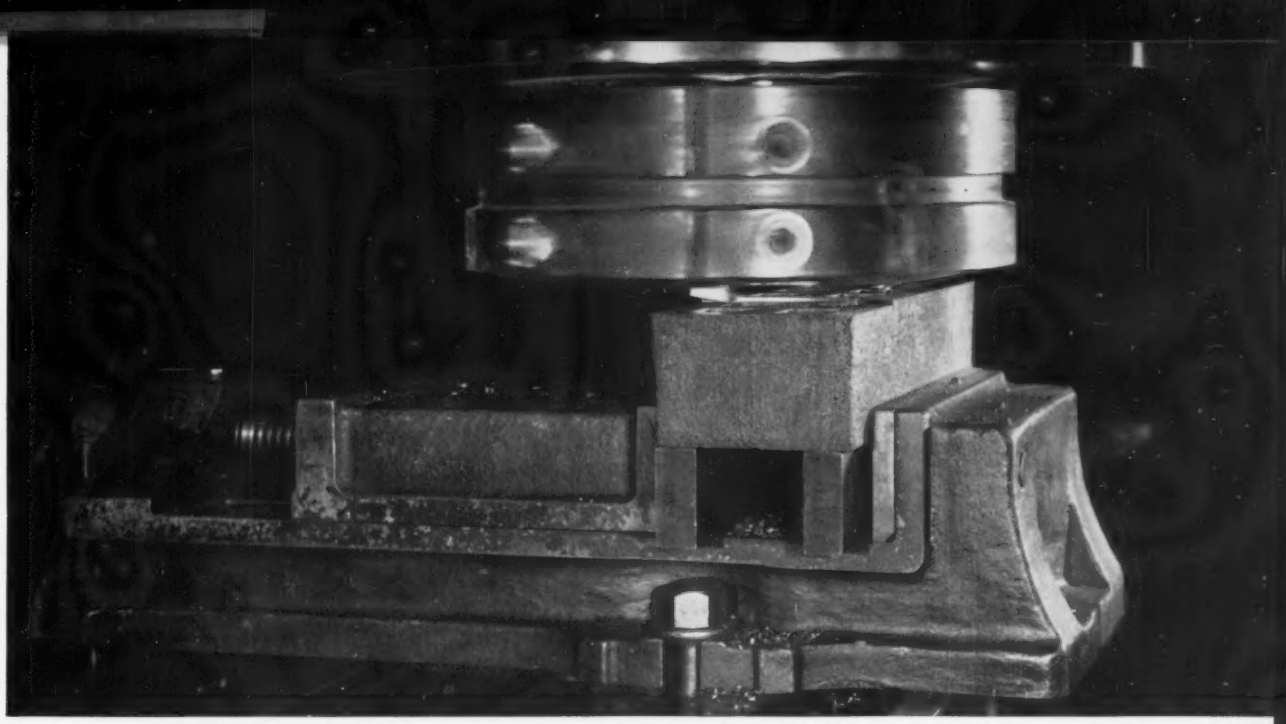
WRITE FOR BULLETIN NO. 1500

DETROIT OFFICE: 3419 South Telegraph Road, Dearborn, Michigan

BARNES DRILL CO.

820 CHESTNUT STREET • ROCKFORD, ILLINOIS

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**



Grade 860 – .012" wear, no chipping

Grade "A" – .035" wear, some chipping

Grade "B" – .025" chipped

Wear land comparison tests prove Grade 860 provides greater resistance to chipping, cratering. After milling 72¾ lineal inches on a cast-iron block with interrupted cuts to simulate cylinder blocks, wear on Grade 860 is minute. Two typical carbides tested under identical conditions show extensive chipping. **Speed** – 377 fpm. **Feed** – .0096". **Table travel** – 1¼ ipm. **Depth of cut** – .100".

On high-tensile gray cast irons . . .

TOUGH, NEW CARBOLOY MILLING GRADE 860 GREATLY REDUCES CHIPPING AND CRATERING

Carboloy® Milling Grade 860 was specially developed to provide longer tool life on the harder, denser types of gray cast iron now coming into common use.

Stronger cutting edges make Grade 860 far more resistant to chipping and cratering than any other available carbide. Tougher internal structure provides longer tool life and more production per grind.

Improves production 20-30%

Carboloy Grade 860 has been tested for almost a year on high-tensile cast irons ranging from 223 to 248 Brinell hardness. Despite scale and interruptions, this new carbide has consistently outperformed ordinary grades by 20-30%.

At speeds ranging from 250 to 300 fpm, Grade 860 produces excellent finishes. It is especially efficient for face milling operations, and can also be used to advantage for plain milling.

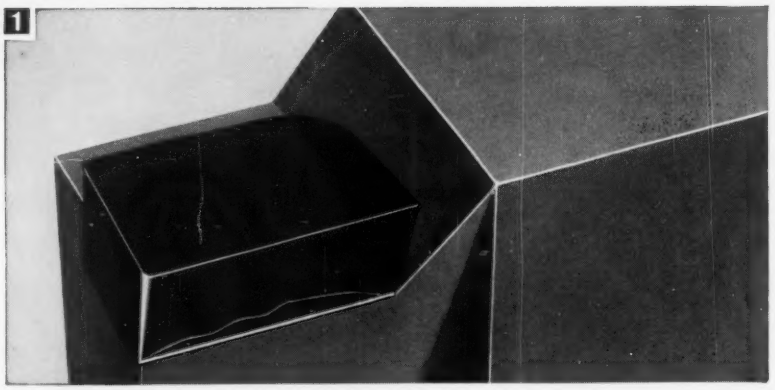
Specify new Carboloy Grade 860 for your milling cutters. For more details or technical information, write today . . . or mail the coupon on page 4 of this advertisement.

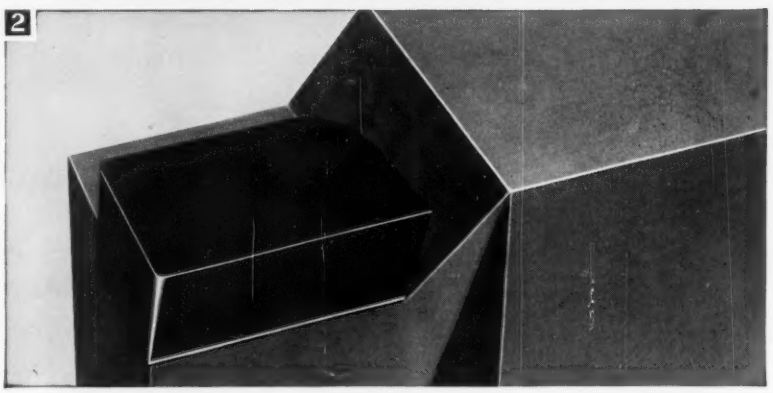
CARBOLOY
CEMENTED CARBIDES

BRAZING CRACKS ELIMINATED

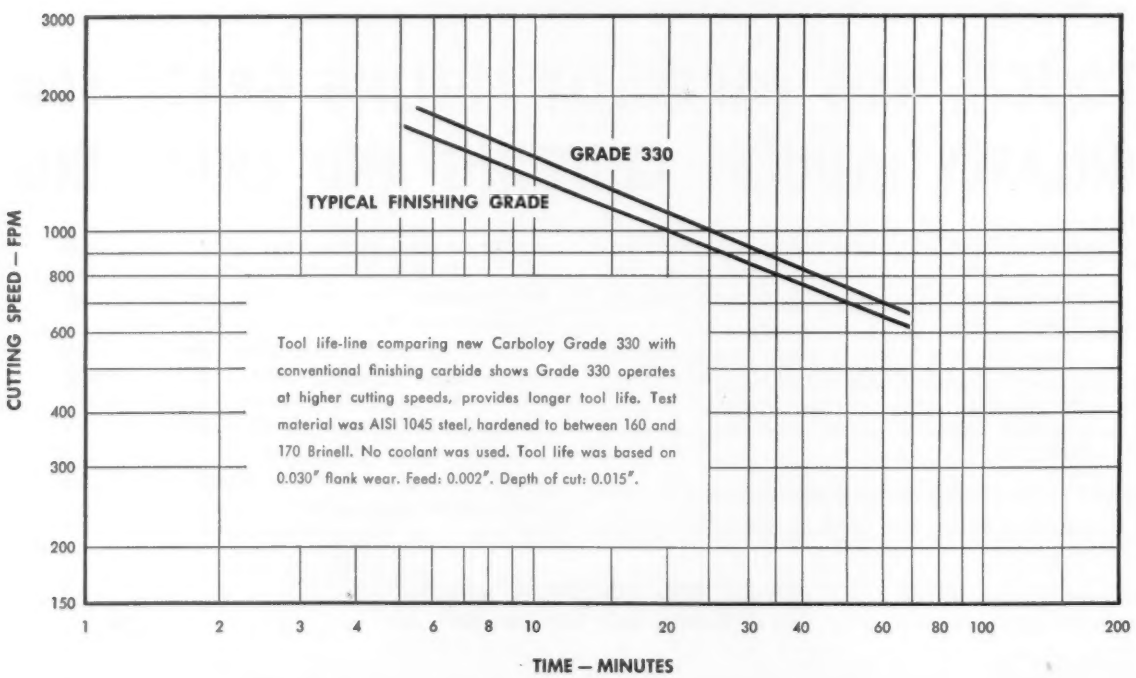
Conventional carbide (Figure 1) shows type of brazing crack that can greatly reduce tool life and increase machining costs.

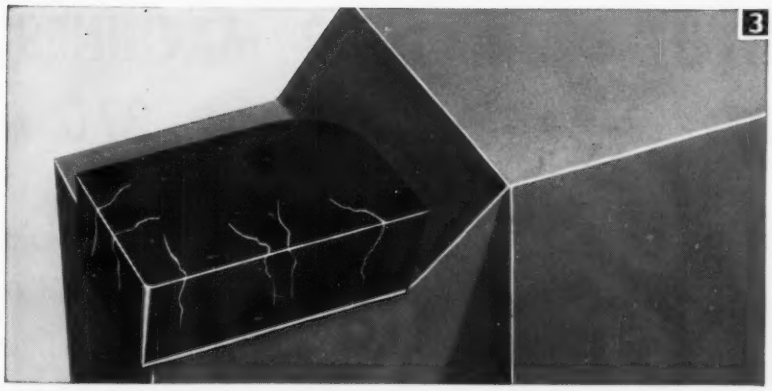
Carboloy Grade 330 (Figure 2) uses nickel binder to provide greater strength and toughness to resist brazing strains. For further protection, the wholly new composition of Grade 330 permits the use of high-silver solders with lower melting points. (Photos have been retouched to bring out brazing cracks difficult to see with the naked eye.)

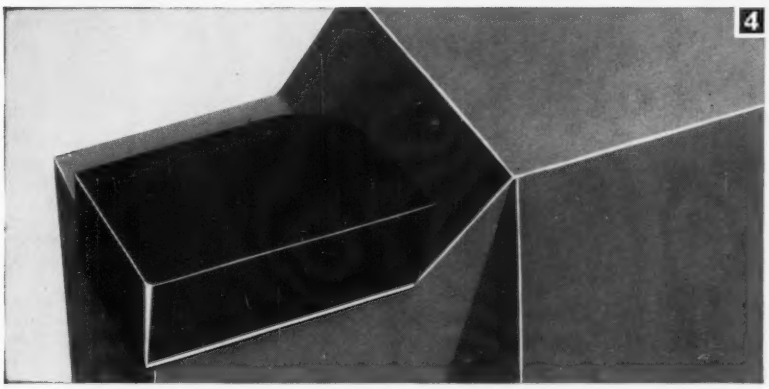




NEW CARBOLOY STEEL-FINISHING GRADE 330







GRINDING CRACKS ELIMINATED

Ordinary steel-finishing carbides are so brittle that grinding cracks (Figure 3) frequently appear. Automatic grinders cannot normally be used.

Because Grade 330 (Figure 4) has twice the transverse rupture strength of ordinary carbides, it has superior resistance to grinding cracks, can be easily ground on duplicating-type grinders. (Photos have been retouched to bring out grinding cracks difficult to see with the naked eye.)

MACHINES FASTER, WEARS 20-35% LONGER

- **Easier to braze and grind**
- **Double transverse rupture strength**
- **More resistant to chipping, cracking**

With a transverse rupture strength of 200,000 psi, new Carboloy Finishing Grade 330 is nearly twice as strong as conventional steel-finishing carbides.

Used on finishing and boring jobs, this extra strength means greater resistance to chipping and cracking, along with improved tool life.

Entirely new composition

The secret of Grade 330 is its higher titanium-carbide content and nickel binder. Grade 330 is tougher, easier to grind, and more wear resistant than cobalt-binder grades.

Production tests on AISI 1045 steel (see chart at left) show Grade 330 can be operated at speeds 10% higher than other carbides without any loss in tool life. When compared at speeds ranging from 600 to 1900 fpm, Grade 330 consistently provided 20-35% longer tool life than other grades.

Extra-performance steel-cutting carbides

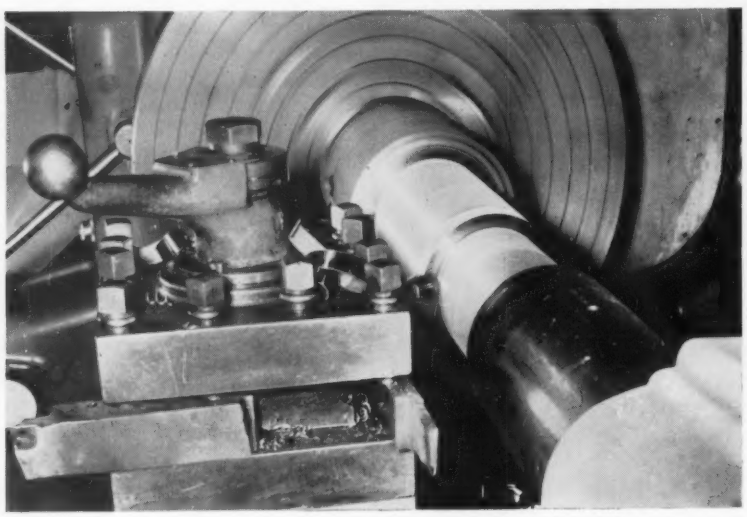
Grade 330 rounds out the Carboloy extra-performance Series 300 carbides (Grades 350, 370), taking up on finishing and boring where Grade 350 leaves off.

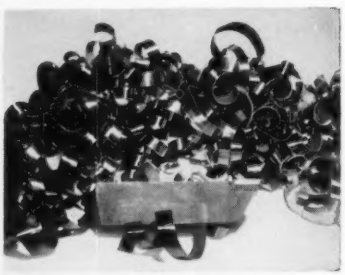
Throw-away inserts, standard blanks, square and solid boring tools are now available from Authorized Carboloy Distributors. For price list and specifications on Grade 330, send the coupon on page 4 of this advertisement.

CARBOLOY
CEMENTED CARBIDES

GET MORE OUTPUT FROM YOUR MACHINES WITH CARBOLOY GRADES 350 AND 370

▶ **Remove more steel per minute** ▶ **Reduce downtime and tool costs**





Eighteen pounds of steel (above) are removed per minute by Grade 370 tool at Improved Machinery Inc., Nashua, N.H. Grade 370 roughs and finishes rolls at twice the speeds of previous carbides, lasts twice as long, saves 14 hours per day in labor.

SETUP: Material—Combination of mild and stainless steel. **Speed**—500-800 fpm. **Feed**—0.021" for roughing; 0.016" for finishing. **Depth of cut**—⅝"-¾". **Coolant**—No.

Carboloy Grades 350 and 370 are *extra-performance* carbides. They are specifically designed to take heavier, deeper cuts at faster speeds . . . to provide maximum machine output at lowest tool cost.

Hundreds of in-plant case histories like the one above have proved Grades 350 and 370 consistently outperform, outwear all other steel-cutting carbides.

Greatly increase output

Even on the toughest jobs, these carbides have brought production increases ranging from 30% to 300% . . . reducing the cost per finished piece.

Carboloy Grades 350 and 370 have a built-in structural rigidity that resists edge deformation even at temperatures as high as 1800° F. Their ability to stay on the job longer means less downtime, more production from the machine.

Complete stocks available locally

Try medium-duty Grade 350 and heavy-duty Grade 370 on your steel-cutting jobs . . . and lower your tooling costs.

Your local Authorized Carboloy Distributor maintains complete stocks of both these grades in a wide range of tools, blanks, and inserts. His name is listed in the Yellow Pages of the phone book. For more information, call him today or mail the coupon below.

CARBOLOY

CEMENTED CARBIDES

METALLURGICAL PRODUCTS DEPARTMENT OF GENERAL ELECTRIC COMPANY

11147 E. 8 Mile Street, Detroit 32, Michigan

Send me more information on:

- ☐ New Milling Grade 860
- ☐ New Finishing Grade 330
- ☐ Grades 350 and 370
- ☐ Send the name of the nearest Authorized Carboloy Distributor

Name_____

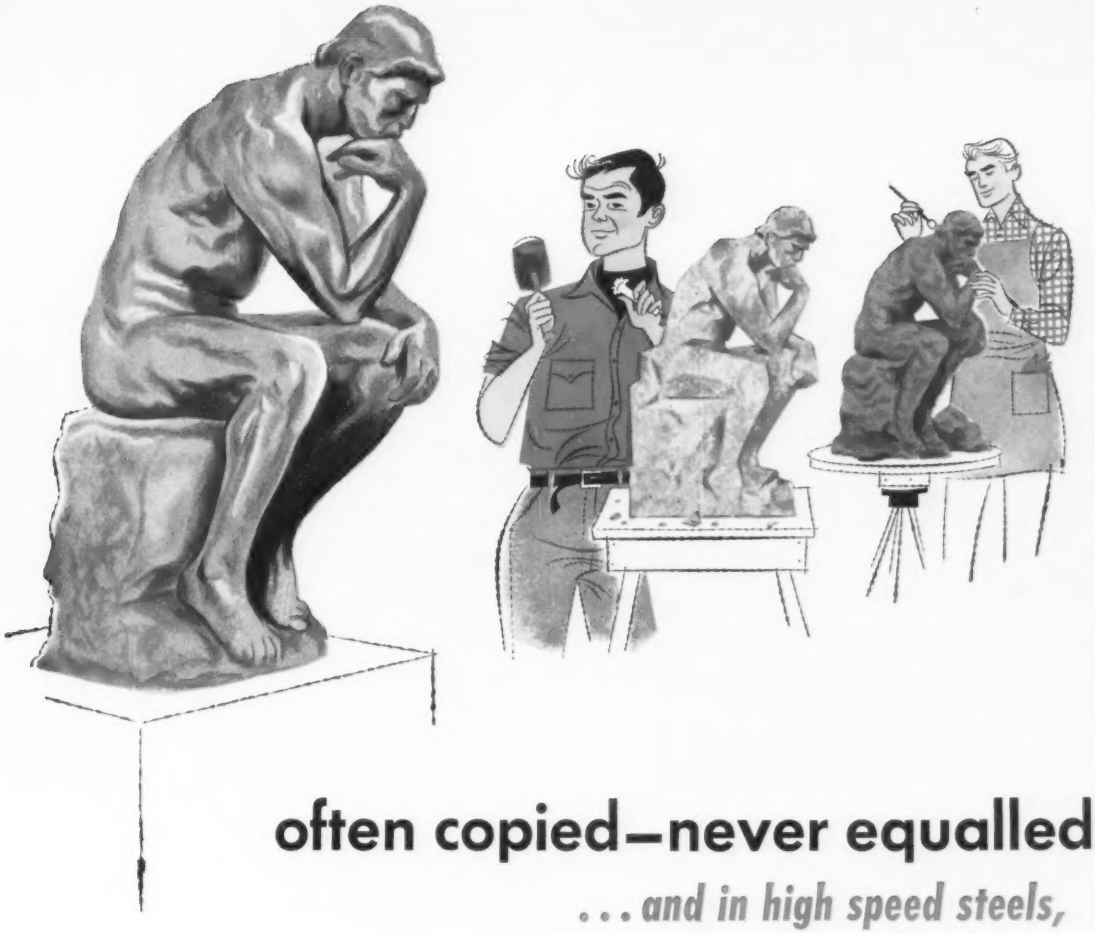
Title_____

Company_____

Address_____

City_____ Zone____ State_____

"Carboloy" is a trademark of General Electric Company



often copied—never equalled

. . . and in high speed steels, nothing has ever equalled REX

Crucible's REX® high speed steel is in a class by itself—has been for more than half a century. And it gets better every year. New improvements in manufacturing techniques have brought even greater uniformity and quality to its well-known properties.

But prove this for yourself—shop-test the new REX in your own plant. Check its structure, uniformity, response to heat-treatment—all-around tool performance. Try REX any way you like—you'll see for yourself why the new REX is still the *standard for comparison* in every high speed steel application.

You can get REX from stock from your nearby Crucible warehouse—or promptly by direct mill delivery. For further information on REX and the many other Crucible special purpose steels, send for the *Crucible Publication Catalog*—it's yours for the asking. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

How to make your automatic heat-treating and hardening even more automatic

...at no extra cost

FAST, continuous operation is the key to profitable automatic forging production lines. Especially in high speed heat-treating and hardening operations. They're extremely sensitive to changes in chemical composition and structure of steel used. Interruptions to make tests or adjustments slow production, increase costs, reduce the advantages of automatic operation. This makes the uniformity of the steel you use an even more vital factor. The more uniform the steel, the steadier the production and the greater the potential you can realize from your automatic equipment.

You can get the utmost in uniformity, and automatic operation—at no extra cost—by using Timken® fine alloy steel. Uniformity is constant from bar to bar, heat to heat, order to order.

We take many extra quality-control steps to assure this uniformity. For example, the Timken Company uses a magnetic stirrer for molten steel to assure equal distribution of alloys, uniform temperature and improved working of the slag. It's the first installation of its type in the United States.

To further assure uniformity, your order of Timken fine alloy steel is handled individually. We target our conditioning procedures to meet your end use requirements. Each bar is stamped to identify the heat it came from. This limits variations within an order as well as from order to order. And every heat is examined spectrometrically to insure uniform grain size.

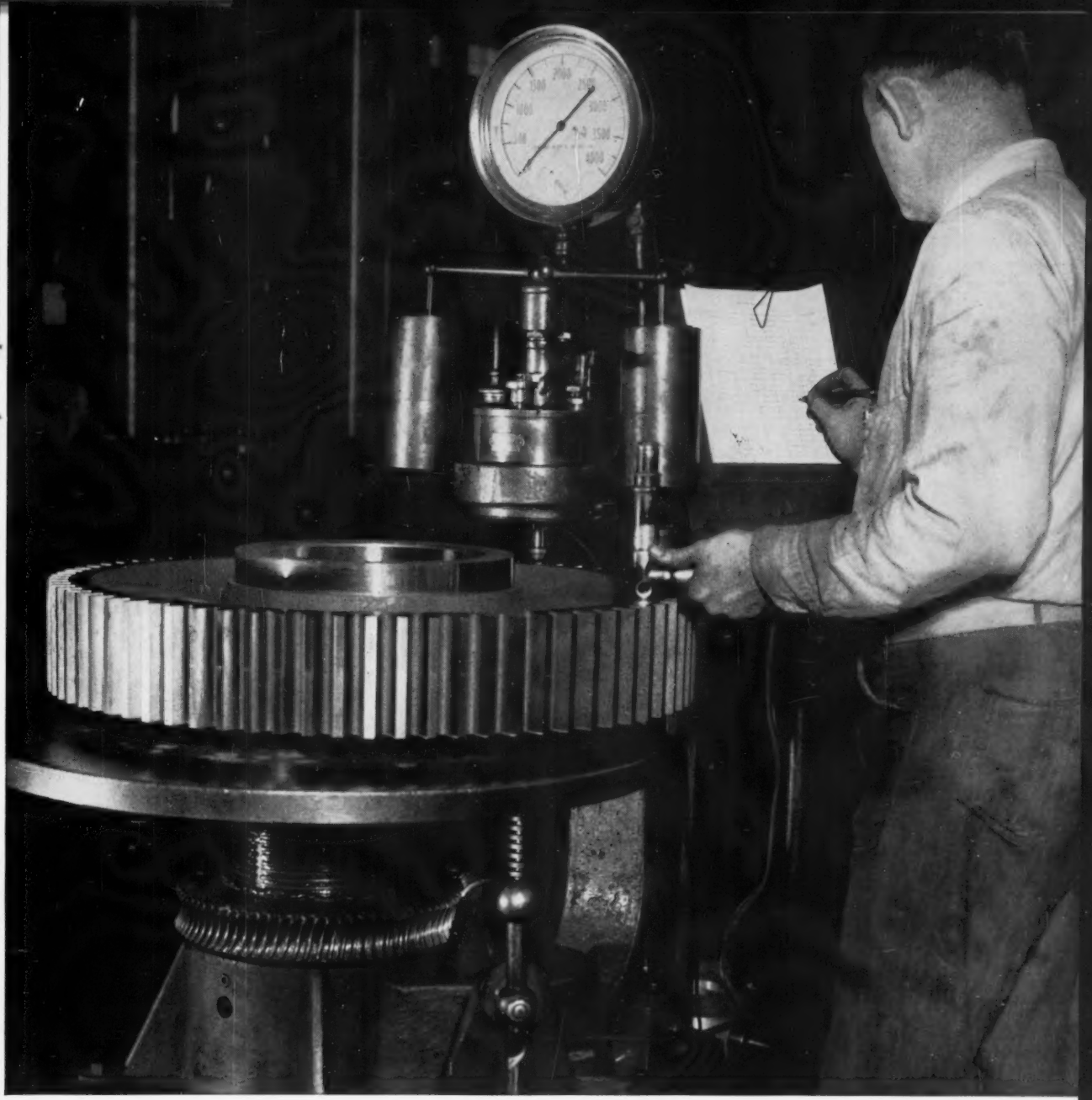
To make your automatic heat-treating and hardening operations even *more* automatic—at no extra cost—always specify Timken fine alloy steel. You'll get money-saving performance and uniform results every time. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

TIMKEN *Fine Alloy* **STEEL**

TRADE-MARK REG. U.S. PAT. OFF.

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS STEEL TUBING

For more information fill in page number on Inquiry Card, on page 241



Sound from Teeth to Hub

This is a mighty rugged spur gear, as indeed it would have to be. It is slated for use in a diesel locomotive, and here the description "heavy-duty service" fits like a glove.

The gear and others like it were fashioned from Bethlehem circular steel blanks, which are both forged and rolled. The forging-and-rolling operation is a unique single-step process that results in uniform density, highly desirable grain flow. The solid, homogeneous metal is easy to machine. To sum it all up, the blanks are *reliable*, all the way through. They make possible gears that are sound from teeth to hub.

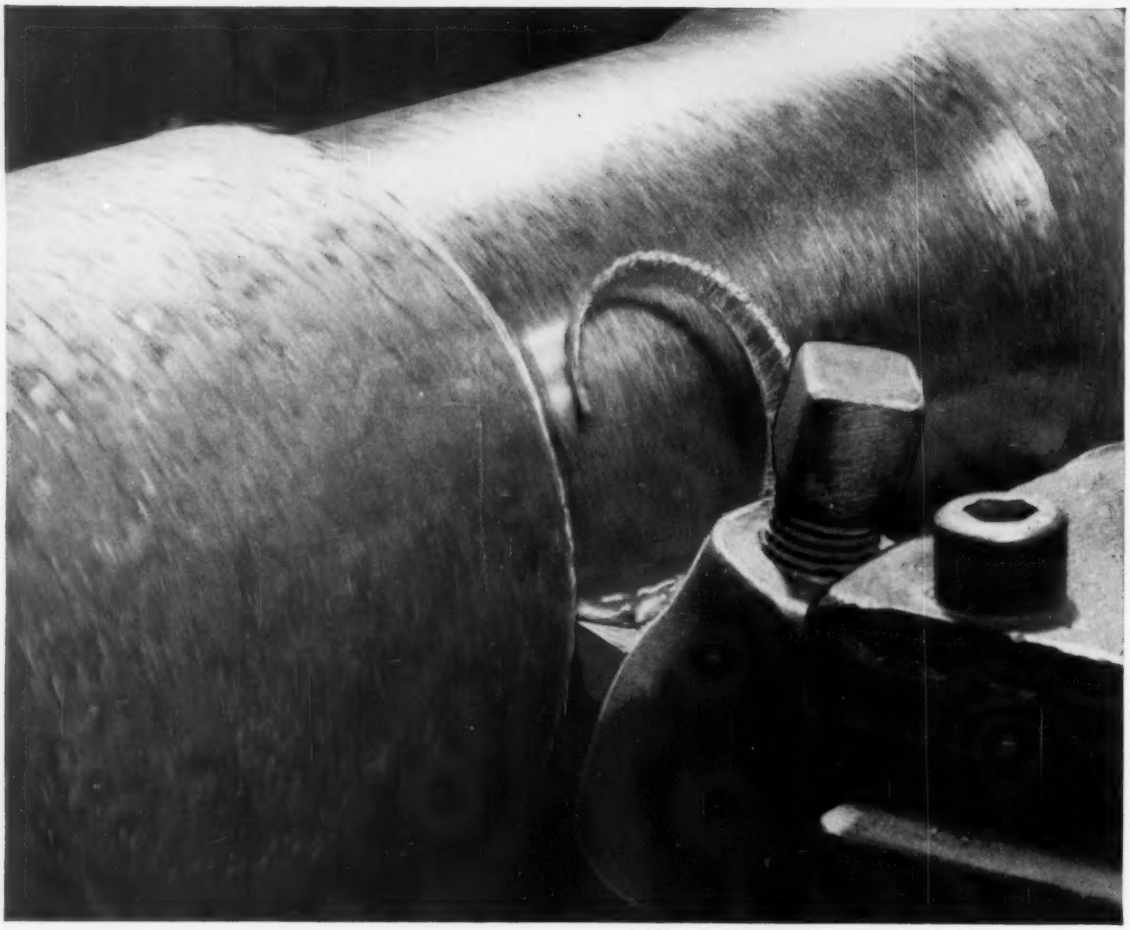
Bethlehem forged - and - rolled blanks are produced in many sizes, the usual range being 10 to 42 in. OD. In addition to their uses in the making of gears, they are also recommended for sheaves, crane wheels, and other circular steel products. A wide choice of sections is available. Write for the full story.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation.
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL



One Pound of Metal Removed Per Minute

Two HAYNES STELLITE alloy tools remove 118 cubic inches of metal from rough, uneven nickel-chromium billets in 20 minutes. They trim ½ in. from the diameter in one pass, and finish two of the 170-lb. billets per grind. Each tool removes about a pound of metal per minute in spite of the irregularity of the billet. Cutting speed is 37 surface ft. per minute and the rate of feed is ⅝ in. per minute. Heat generated during the cutting operation quickly dulled the cutting edges of high-speed steel tools tried on this job, and the rough cut caused other tool materials to chip. Only HAYNES STELLITE 98M2 cobalt-base alloy tools proved to be both hard and tough enough to do the job efficiently.

HAYNES STELLITE alloy tools are successful on applications like this one because they have good impact strength, high compressive strength, and their cutting edges remain hard and sharp even when red hot. They remove metal fast. They can be used at high speeds with comparatively high feed rates, and they take deep cuts.

More information on HAYNES STELLITE tools and how they can be used to best advantage is contained in the booklet, "HAYNES STELLITE Metal-Cutting Tools." Write any of the district offices listed below for your copy.

HAYNES TRADE-MARK ALLOYS

HAYNES STELLITE COMPANY

A Division of Union Carbide and Carbon Corporation

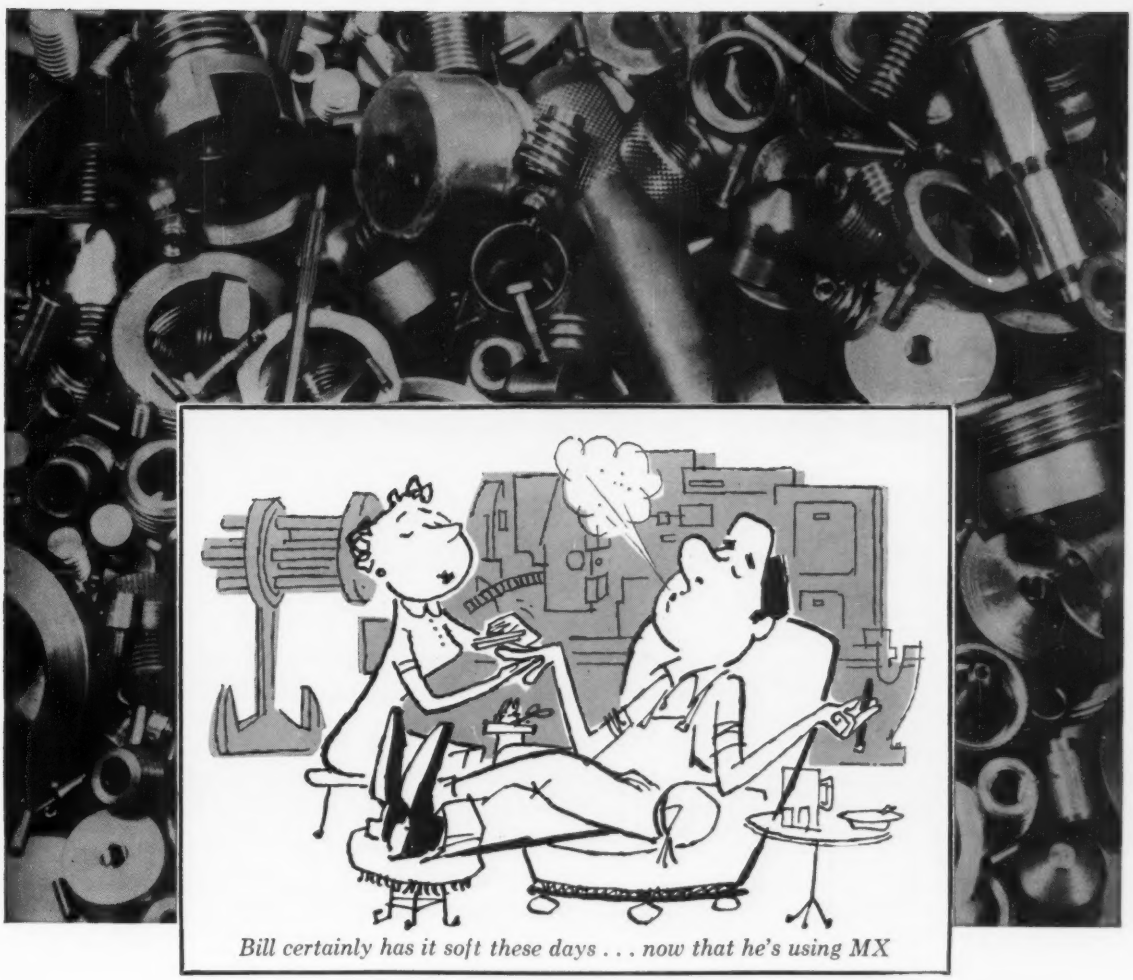
UCC

General Offices and Works, Kokomo, Indiana

Sales Offices

Chicago • Cleveland • Detroit • Houston • Los Angeles • New York • San Francisco • Tulsa

"Haynes" and "Haynes Stellite" are registered trade-marks of Union Carbide and Carbon Corporation.



Bill certainly has it soft these days . . . now that he's using MX

Life can be beautiful!

When parts are coming off the machine faster than ever before—when your tools are lasting up to twice as long between grindings—when you're getting clean, sharp, accurate finish right along—when your production is up and your costs are down—in other words, when you're running on USS Free-Machining MX, life can indeed be beautiful.

Hundreds of shops that have put this high speed, fast cutting bar stock to work in the past five years have proved this to be true. And, almost without exception, *cost savings* have been recorded. That's because MX, despite its better performance, actually costs no more than ordinary screw stock. So when you get more parts per hour, with fewer rejects and less tool grinding, such cost reductions are *clear* savings. These savings have averaged between 10 and 15%—have sometimes run as high as 40% or better.

Prove this for yourself. Switch to MX. Produced in all the popular screw stock sizes, it is sold in cold-finished form by your regular supplier, either as "MX" or under his own identifying trademark. In hot-rolled form, MX is available direct through our nearest district office.

UNITED STATES STEEL CORPORATION, PITTSBURGH
AMERICAN STEEL & WIRE DIVISION, CLEVELAND
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL SUPPLY DIVISION
WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

Bigger output . . . longer tool life . . . fewer rejects

—when you do the job with free-machining **MX**

USS

UNITED STATES STEEL

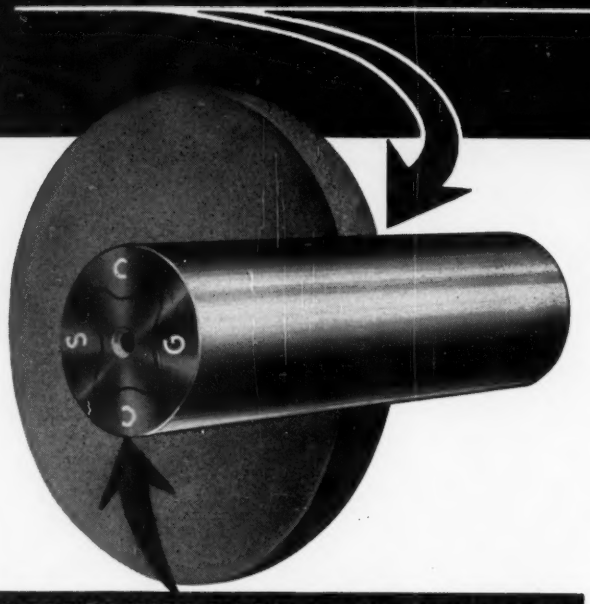
For more information fill in page number on Inquiry Card, on page 241

An exclusive GRINDING PROCESS...

makes

CUMBERLAND STEEL BARS

concentric, straight,
smooth & *really* accurate



BE SURE OF THIS MARK ON THE END OF YOUR SHAFTS

CUMBERLAND GROUND BARS FOR ALL TYPES OF MACHINES

They are carefully ground to our standard manufacturing tolerance, plus nothing to minus .002" on diameters 1-1/8" to 2-7/16" inclusive . . . plus nothing to minus .003" on diameters 2-1/2" to 8" inclusive. Closer tolerance can be furnished, if desired. And, remember, Cumberland Steel Bars are the end result of 109 years' experience,—and every bar is *carefully tested* before shipment. The list of Cumberland's customers reads like the "Blue Book" of Industry. Ask for further information.

MANUFACTURED IN THREE SPECIFICATIONS

Cumberland Brand—AISI C-1020/C-1025, Elastic Limit 30,000# Min.
Potomac Brand—AISI C-1040, Elastic Limit 45,000# Min.
Cumsco Brand—AISI C-1141, Elastic Limit 57,000# Min.

CUMBERLAND STEEL COMPANY

CUMBERLAND, MARYLAND, U.S.A.

ESTABLISHED 1845 **INCORPORATED 1892**

For more information fill in page number on Inquiry Card, on page 241

The gears in an automatic nut former have to be tough and strong to withstand heavy, varying loads. Yet, the castings from which they're made should be easy to machine. That's why this gear for a Waterbury Farrel Automatic Nut Former is made from ASTM-50 gray iron with a nominal composition of 1% nickel and .50% molybdenum.

Moly gives cast iron gears higher strength with toughness and good machinability

"To insure a tough, easily machined gray iron for the gears in our Automatic Nut Formers," says Henry C. Griggs, Metallurgist for Waterbury Farrel Foundry & Machine Co., "we specify .50% molybdenum in our ASTM-50 material. The properties of this material contribute importantly to the reputation of Waterbury equipment for accuracy and high speed production under severe operating conditions."

Molybdenum helps to give reliable and reproducible castings — very important factors in consistent performance of gears.

Investigate moly irons. They may be the key to better performance in many of your gear applications.

For the first two in a series of bulletins, "Why Moly Iron," or for technical assistance, write Climax Molybdenum Co., Department 13, New York 36, N. Y.

CLIMAX MOLYBDENUM

HAVE YOU HEARD ABOUT THIS EXTRAORDINARY CLEANER?

It saves money in paint shops!

Oakite Rustripper is an alkaline material that strips paint, pigment residues and phosphate coatings from steel at the same time that it removes rust and oil.

It saves money in plating shops!

Oakite Rustripper removes rust or heat scale from steel at the same time that it removes oil and other soils. It avoids hydrogen embrittlement, damage to machined surfaces and other disadvantages of acid pickling.

FREE

For more information about how Oakite Rustripper eliminates operations in paint shops and plating shops, send for one or both of the illustrated booklets listed in the coupon.

Here's the best shortcut in the field of organic finishing
RUSTRIPPER
Here's the best shortcut in the field of electroplating
RUSTRIPPER
OAKITE PRODUCTS, INC.

Technical Service Representatives in Principal Cities of U. S. and Canada

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Name _____

Company _____

Address _____

Paint Shop Men Save Time With New Kind of Stripper

INDIANA: "We formerly stripped TV cabinet rejects in 25 minutes. They came out a brown tarnished color . . . Had to pickle to remove phosphate coating . . . Today Oakite Rustripper strips the same cabinet in less than 10 minutes, bringing it out so bright and clean you can't tell it from a new one . . . Pickle, neutralize and rinses eliminated."

NEW YORK: "It used to take two hours to strip synthetic enamel from these rejects (filing cabinets). Now Rustripper does them in about two minutes. We used to soak conveyor chain links overnight and work hooks for several days. Rustripper does both jobs in two hours and cuts out the wire brushing for rust."

COLORADO: "We were amazed at the results . . . a perfect job of stripping gray OD enamel, red oxide prime and surface rust from bomb clusters. Oakite Rustripper is the finest material ever used here."

Send for free booklet "*Here's the best shortcut in the field of organic finishing.*" See coupon at left.

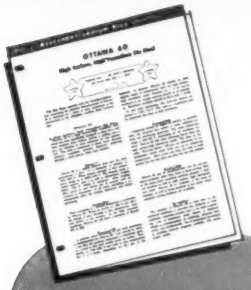
Electroplaters Find Profit in Alkaline Derusting

CALIFORNIA: "Formerly sand blasted the heat scale off these aircraft parts. Now the scale is removed in about 30 minutes with a boiling soak in Rustripper at 4 pounds per gallon, rinse, reverse-current clean, rinse; followed by cyanide dip and cadmium plate."

NEW YORK: Removing heavy heat-treat scale, rust and soil from steel aircraft parts before cadmium plating. Also cleaning stainless steel landing gear parts after hardening. Using 3 pounds Oakite Rustripper and 10 ounces sodium cyanide per gallon at 120°F. with periodic reverse current. "An excellent job is being done . . . Parts are being descaled that we couldn't touch without pickling in muriatic acid . . . Everyone astounded at life of solution, since this bath is worked very hard and former bath required heavy upkeep . . . Appears likely to save about $2000 in first year."

CALIFORNIA: "Oakite Rustripper seems to be what hard chrome platers have been waiting for." Used for removing rust from steel shafts after chrome plating, baking, machining, etc., and before oiling. Rust was formally rubbed away with emery paper.

Send for free booklet "*Here's the best shortcut in the field of electroplating.*" See coupon at left.



Write for a copy of the OTTAWA 60 BLUE SHEET

This Blue Sheet contains certified data on the physical characteristics of Ottawa 60, prepared from carefully checked laboratory and field service tests. All the information you'll need on methods of handling and heat treatment, etc.

ADDRESS DEPT. M-80

OTTAWA 60 is a *new* die steel, an A-L "original," developed primarily to deep draw and form stainless steel. As intended, it performs without galling or pickup and shows exceptional wear resistance in that service. We have plenty of case histories to show you in proof.

But *wherever* you use Ottawa 60 draw dies—not just on stainless steel—this high-carbon, high-vanadium alloy comes through for you. Illustrated above are the first and second draws on transformer housings, produced from .037" gauge SAE 1010 strip. The company formerly used dies made of 5% chrome air-hardening die steel—and later a more highly alloyed material—without ever getting more than about 2000 pieces before the dies began to show gall marks and pickup, and parts were rejected due to scoring, breakage and oversize. *Dies made from Ottawa 60 forgings cured that! Results after 25,000 pieces showed no pickup and no wear on punch or die.*

● You can solve many a problem and save real money with Ottawa 60 draw dies! Write for information or call in our Field Service Staff to help you get started. ***Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh 22, Pa.***

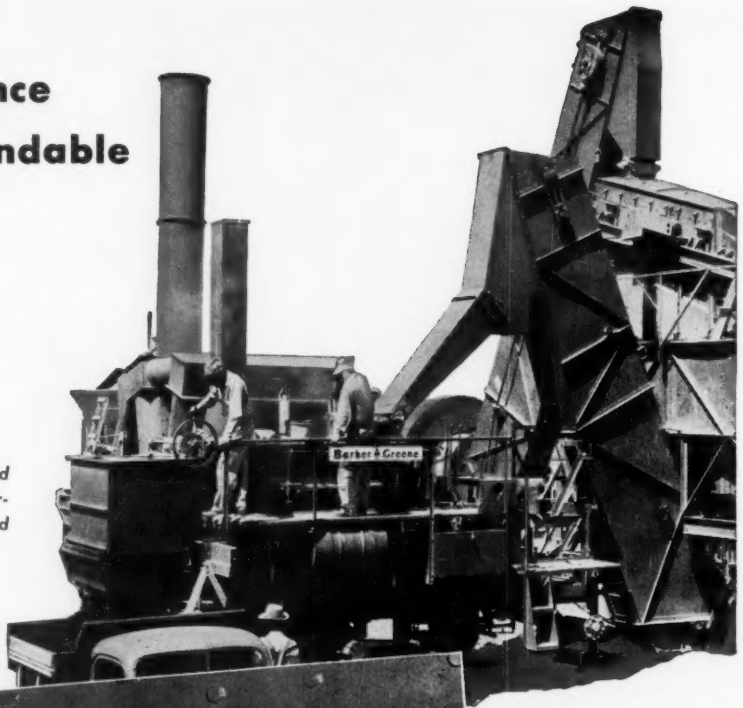
For complete **MODERN** Tooling, call

Allegheny Ludlum

WAD 5463

AL® FINE TOOL STEELS SINCE 1854

machines of great performance use the most dependable oiling system ever developed



A Model 50 Madison-Kipp Lubricator installed as original equipment on a Model 848 Barber-Greene Asphalt Mixing Plant manufactured by Barber-Greene Co., Aurora, Illinois.

MADISON-KIPP *Fresh Oil*

. . . by the measured drop, from a Madison-Kipp Lubricator is the most dependable method of lubrication ever developed. It is applied as original equipment on America's finest machine tools, work engines and compressors. You will definitely increase your production potential for years to come by specifying Madison-Kipp on all new machines you buy where oil under pressure fed drop by drop can be installed. There are 6 models to meet almost every installation requirement.

kipp

MADISON-KIPP CORPORATION
203 WAUBESA STREET • MADISON 10, WIS., U. S. A.

• Skilled in Die Casting Mechanics • Experienced in Lubrication Engineering • Originators of Really High Speed Air Tools

For more information fill in page number on Inquiry Card, on page 241

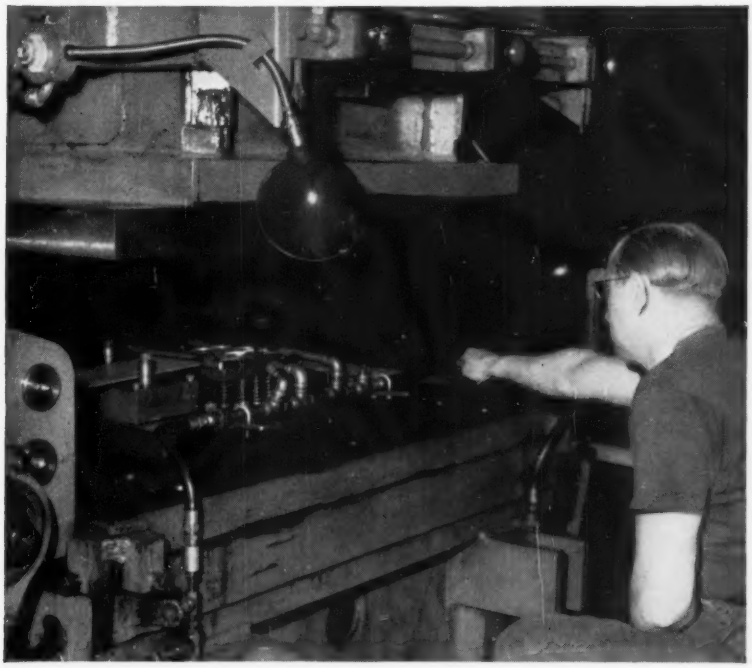
Tool Steel Topics

BETHLEHEM STEEL

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

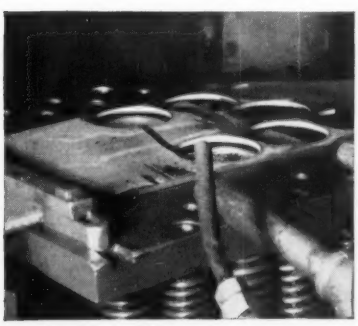
Export Distributor: Bethlehem Steel Export Corporation



Maker of Washers Rings the Bell with Die Made of Lehigh H

A manufacturer of steel washers found that by using a piercing die made of Lehigh H tool steel, he could get longer, more economical production runs than with dies of another grade, formerly used.

The Lehigh H die produces thousands of round washers daily, in sizes from 5/8 in. to 1 in. It is hardened to approximately Rockwell C 61, and pierces 5/32-in. C 1035 steel sheet. Because of the severity of the piercing operation, redressing of the die is required after every third turn, but only 0.020 in. is removed. Close to 100,000 washers are turned out between grinds.



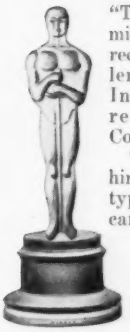
Lehigh H handles this blanking job to perfection because of its outstanding wear-resistance and toughness. Lehigh H is a superb high-carbon, high-chromium grade of air-hardening tool steel. It can always be counted upon for a good job because of its resistance to wear, minimum distortion in heat-treatment, and high compressive strength.

TYPICAL ANALYSIS

Carbon 1.55	Molybdenum 0.80
Chromium 11.50	Vanadium 0.40

If there are applications in your shop which require a combination of wear- and shock-resistance, plus high compressive strength, look into the advantages of Lehigh H. Your local Bethlehem tool steel distributor, as friendly a man as you'll find anywhere, is at your service.

FILM "TEAMWORK" WINS AWARD AT COLUMBUS FESTIVAL



"Teamwork," our new 30-minute color film on tool steel, received an award for excellence in the Business and Industry category at the recent Fourth Annual Columbus Film Festival.

"Teamwork" takes you behind the scenes in describing typical applications of our carbon, oil- and air-hardening, shock-resisting, hot-work and high-speed tool steels. It is now available for showings to die-makers, heat-treaters, machinists, machine-tool manufacturers and distributors. It's also an excellent film for technical society meetings, and for student groups.

It's easy to arrange to see "Teamwork." All you need do is drop a line to the nearest Bethlehem office, or to Publications Department, Bethlehem Steel Company, Bethlehem, Pa. If possible, please select a showing date well in advance, to allow time for scheduling and shipping.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Punched Holes Often Close-in

In precision punching it is common practice to make the punch diameter exactly the same as that of the desired hole. (All the clearance required is then applied to the I.D. of the die.) For many operations involving holes greater than 1 in. diameter, for example, and stock less than 1/8 in. thick, this procedure is correct. But in other operations it is incorrect, because the elasticity of the stock causes the holes to close-in after punching, so that the holes are actually smaller than the punch which made them.

With large-diameter holes and thin stock, the elastic springback which tends to close-in a punched hole causes the stock to buckle instead, so that the hole diameter will be accurate under these conditions. On holes 1 in. in diameter and smaller, expect a close-in of 0.002 to 0.003 in. with stock 1/8 in. to 1/4 in. thick, and a closing of 0.001 in. on stock 0.030 in. thick (22 gage). Closing will be negligible on stock 0.010 in. thick (32 gage) or less. For precision punching, therefore, add the expected close-in to the punch size to produce the correct hole diameter.

FACTS

about

NEW DEPARTURE
BALL BEARINGS

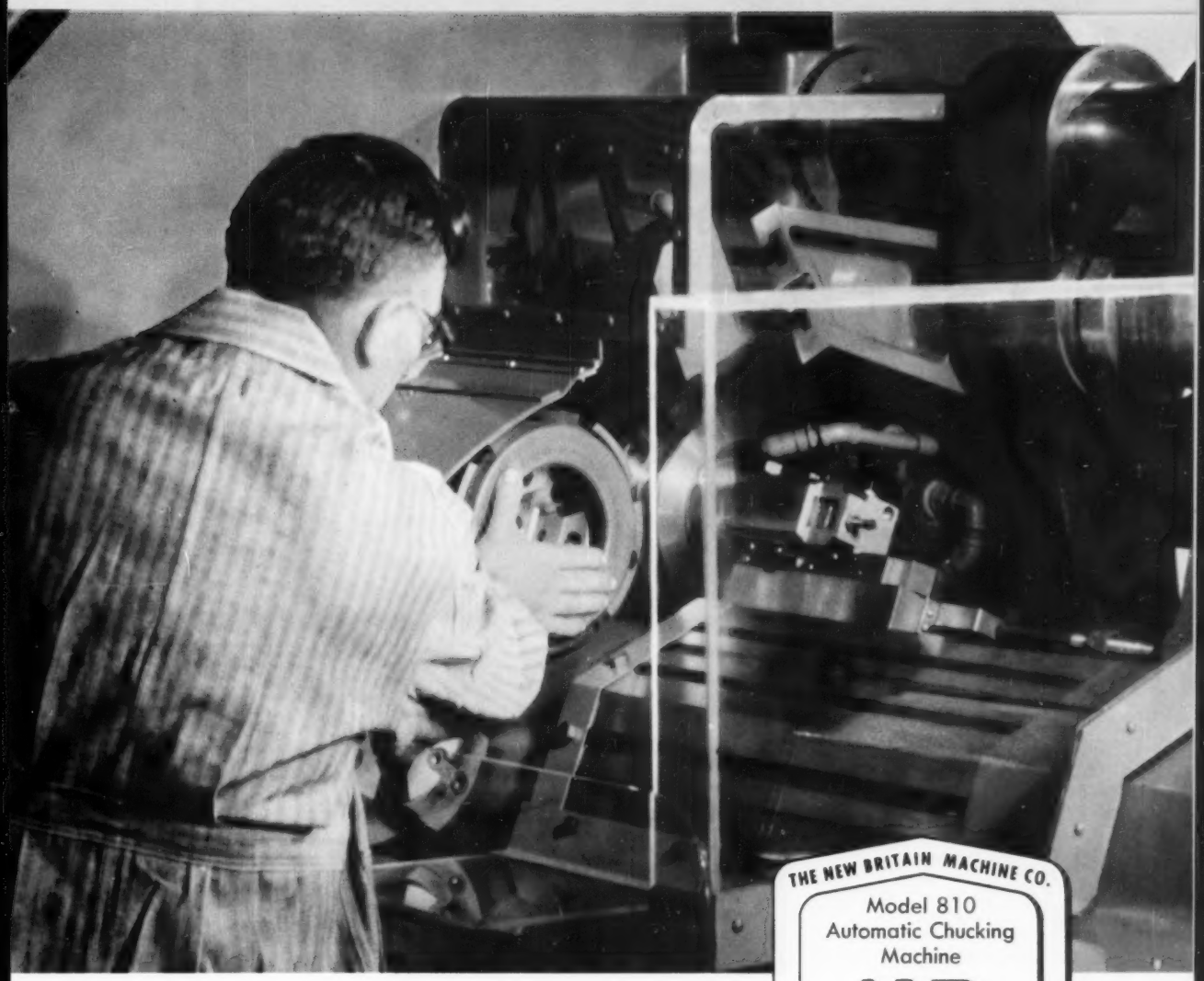
EXPERIENCE...

FOUNDATION OF OUTSTANDING QUALITY

● In manufacturing highly specialized precision products, such as New Departure ball bearings, there is no short cut to the knowledge and skill gained by long experience. The superiority of the methods, materials and the products resulting from New Departure's sixty years of manufacturing experience is recognized wherever precision ball bearings are used.

BALL BEARINGS MAKE GOOD MACHINES BETTER

NEW DEPARTURE • DIVISION OF GENERAL MOTORS • BRISTOL, CONN.

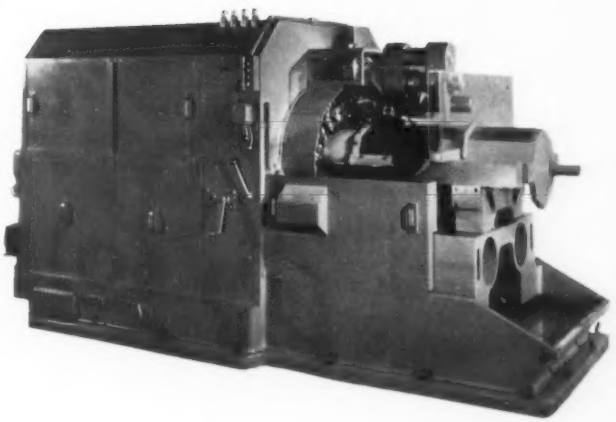


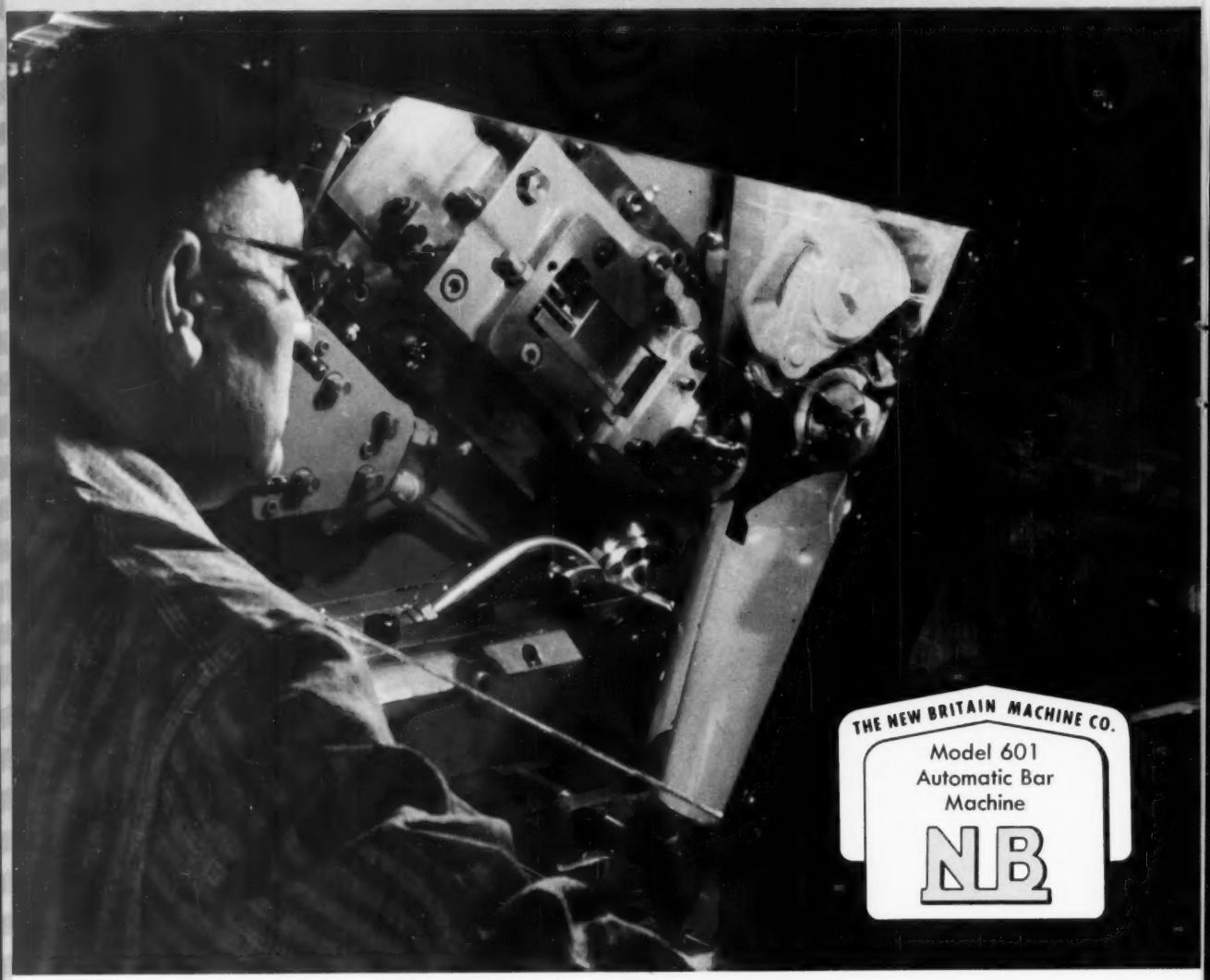
new New Britain chuckers handle bigger work pieces

If you know chucking machines you know the world-wide reputation of New Britains for accessibility, versatility, quick setup and sustained high production of precision parts.

Now new New Britain models enable you to apply this high productivity to pieces with chucking diameters up to ten inches on eight-spindle machines, twelve inches on six-spindle production and fifteen inches on four-spindle work.

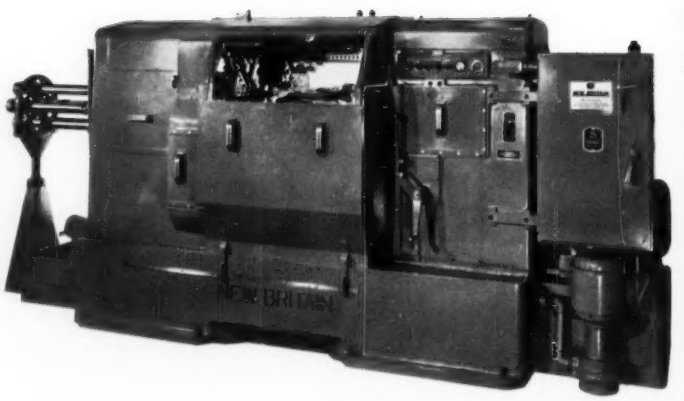
Check this practical approach to more profitable production with your New Britain representative, or write for Bulletin 3R. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.





8 tons of metalworking efficiency

If you are interested in absolute minimum cost per piece on either long or short runs, investigate the Model 601 New Britain bar machine. Massive enough and powerful enough to handle your new high-speed cutting requirements. Super-high spindle speeds, maximum versatility, optional universal tool slide cam which eliminates cam change time. With the Model 601 on your floor you have "the shortest distance" between bar stock and finished piece. Write for Bulletin 6H.



IT'S NEW

IT LISTS ALL PRODUCTS

COMPLETE CATALOG NO. 56

576 pages with complete information on 7124 standardized products FROM STOCK!

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SPUR · MITER & BEVEL · HELICAL · WORMS & WORM GEARS · PINION WIRE · RACK · STEM PINIONS

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BORED-TO-SIZE SPROCKETS · SINGLE · With Keyway and Setscrew · INTERCHANGEABLE · TAPERED BUSHINGS AND SPROCKETS

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REDUCTORS · FLANGED REDUCTORS · RATIOMOTORS

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BOSTON Gear BRONZE BEARINGS Oil-Impregnated BOST-BRONZ · BALL BEARINGS · PILLOW BLOCKS

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50 pages of engineering data for drive design

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No. 55

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on the bigger-than-ever BOSTON GEAR line. Lists hundreds of new products—new models—new sizes. Get your copy—it's your indispensable guidebook to new efficiency, new economy in power transmission. Boston Gear Works, 65 Hayward Street, Quincy 71, Massachusetts.

NOW AVAILABLE FROM YOUR

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568G-NC23

There is greater versatility available with Bridgeport MILLERS

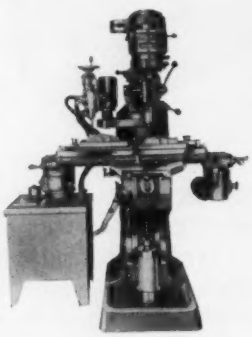
WHEN you buy the BRIDGEPORT TURRET MILLING MACHINE, you buy more than a conventional machine of this type. You actually buy and get a machine in a type which has been conceived, created and developed by Bridgeport. In addition to the turret principle originated by Bridgeport, attachments have been designed which add a great many features to the machine so that its basic purpose for milling, drilling, boring and shaping has been extended to include also cherrying, right angle milling as well as copying with the Bridgeport Hydraulic True Trace Combination.

One of the outstanding advantages of this machine is that you can buy this basic machine with some or all of these attachments or add them later whenever the need arises for the handling of specific operations.

Investigation of BRIDGEPORT TURRET MILLING MACHINES and their many attachments is always in order.

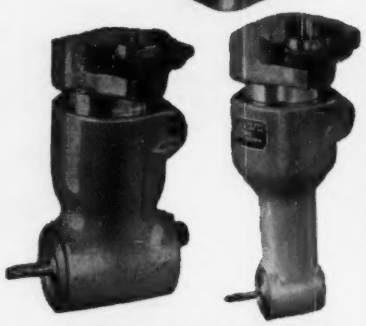
CHERRYING ATTACHMENT

Makes possible production of convex and concave shapes. Ideal for producing drop forge dies, molds, cavities.



TRUE TRACE COMBINATION

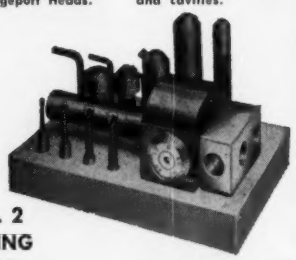
The Bridgeport True Trace Combination will give excellent performance and save endless hours when copying irregular dies and molds.



RIGHT ANGLE ATTACHMENTS

(Above) Heavy Duty . . . for milling and drilling at right angles; fits both Master and 1 HP Bridgeport Heads.

(Above) Light Duty . . . for right angle milling and drilling narrow, deep molds and cavities.



NO. 2 BORING HEAD

Boring Tools and Holder provide means for boring holes up to 6" diameter; available for use on Bridgeport 1 HP Milling, Drilling and Boring Attachment.

Investigation of Bridgeport Milling Machines and their many attachments is always in order.

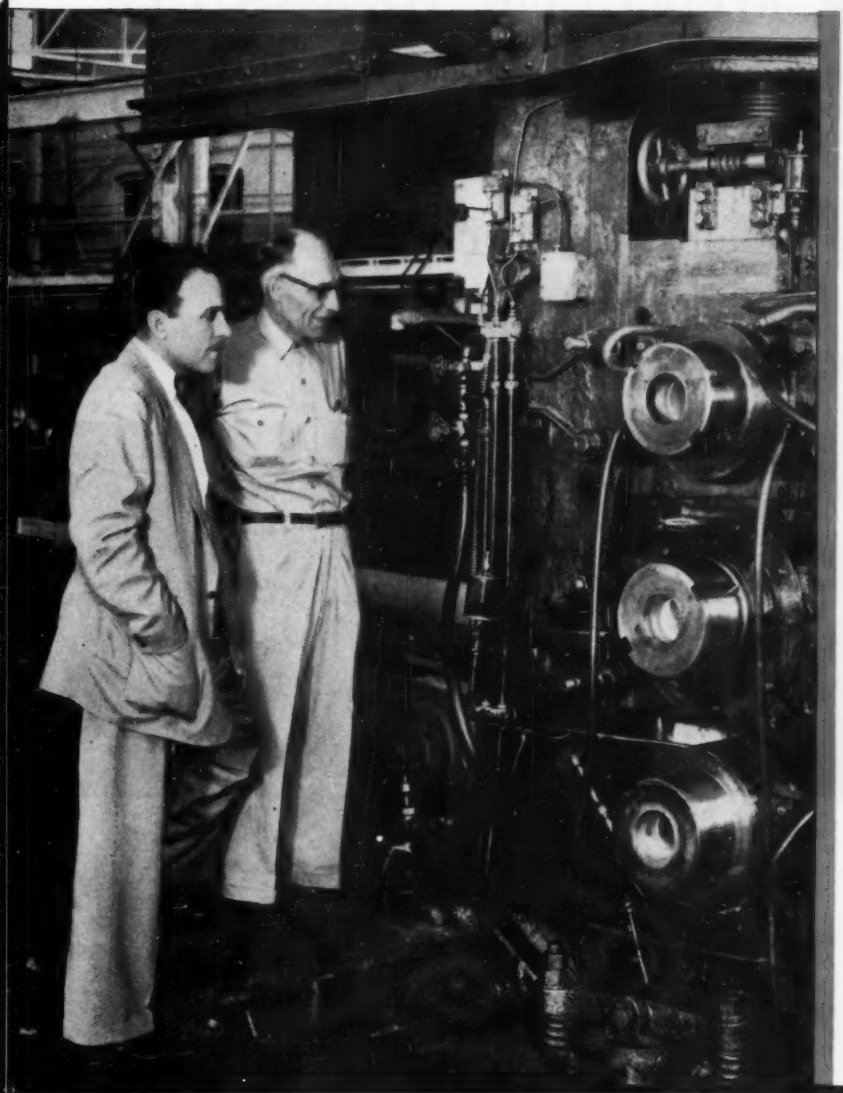
Bridgeport MACHINES, INC.

Bridgeport, Connecticut

Manufacturers of High Speed Milling Attachments and Turret Milling Machines

For more information fill in page number on Inquiry Card, on page 241

Sick slab roll recovers fast with application of STANOGEAR *Compound*



A slab roll at Matthiessen & Hegeler Zinc Company, La Salle, Illinois, was sick. It suffered from repeated roll neck bearing failures. Bearing temperatures couldn't be controlled. A consultant was summoned—Marshall J. Fox, Standard Oil lubrication specialist. His diagnosis and remedy: Install STANOGEAR Compound and equip the machine with a central pressure system for application. Recommendations were followed. Result: No bearing failures, due to faulty lubrication, since. Maintenance costs reduced. Time lost through breakdowns slashed.

This was a condition made to order for STANOGEAR to remedy. And Matthiessen & Hegeler knew there was a man at hand who could suggest what should be done. It's another demonstration of what this unbeatable combination can do when put to work:

1 **Standard Oil lubrication specialists capable of giving technical help.**

2 **Top quality products *that deliver results required.***

STANOGEAR Compounds contain special additives making them suitable for applications where heavy loads cause welding, seizure or scoring.

In the Midwest and Rocky Mountain states, a Standard Oil lubrication specialist in your nearby Standard Oil office will gladly give you more information about STANOGEAR. Call him. Or contact Standard Oil Company, 910 So. Michigan Avenue, Chicago 80, Ill.

Eugene Ewald (right), Mill Foreman, and Marshall Fox, Standard Oil lubrication specialist, inspect slab roll. STANOGEAR Compound helped solve lubrication problem on roll neck bearings.

Marshall Fox who proposed switch to STANOGEAR with resultant improved operation, is experienced in providing such technical service. Marsh has a Mechanical Engineering degree from Purdue to qualify him for this work. In addition, he has completed Standard's course for sales engineers. This experience and training, customers find, pay off for them.

STANDARD

STANDARD OIL COMPANY

(Indiana)

MUELLER BRASS CO.

improves LENSOMETER

lower cost

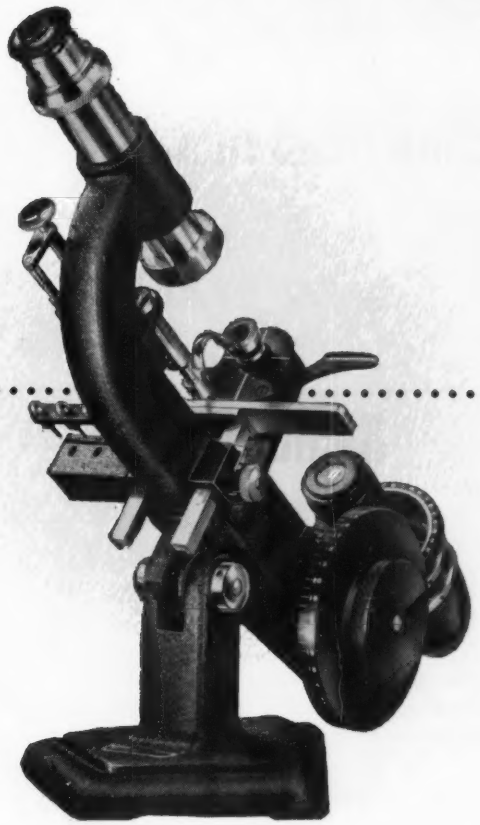
FORGED PART APPROXIMATELY ½ SIZE

Precision and extreme accuracy are vitally important functions of the Lensometer, manufactured by the Instrument Division of the American Optical Company, Buffalo, N. Y. The Lensometer is used to determine the focal strength and axis of an optical lens and, consequently, must be extremely precise in operation to provide accuracy and uniformity in lens prescriptions.

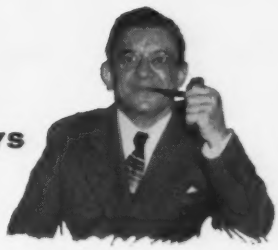
Forgings made by the Mueller Brass Co. play an important role in the construction of the Lensometer and contribute to its outstanding performance. Formerly, the body of the Lensometer was produced from *three* sand castings, but these now have been replaced by just *two* forgings. Naturally, this simplifies assembly, and the big forged bronze main support arm, shown above, along with the lens support bracket insures the constantly accurate alignment of the instrument. During the first year when forgings were used instead of castings, American Optical not only recovered the initial tooling costs but also realized considerable savings on each Lensometer produced. This is another good example of the way Mueller Brass Co. forgings can benefit a product two ways . . . better performance and lower costs. Chances are, your product can likewise be improved at a savings to you if you specify brass, bronze or aluminum forgings made by the Mueller Brass Co.

FORGING

at substantially



METALS AND ALLOYS REVIEW



by FRANK M. LEVY

Vice-President and Director of Research

One of our most interesting series of alloys is the group which we market under the tradename "Tuf-Stuf" . . . a group of aluminum bronze alloys with range and flexibility to meet the most demanding needs. They are high copper base alloys containing from 9% to 13% aluminum and varying amounts of iron, nickel and manganese. Being free of zinc, they are not subject to dezincification. Tuf-Stuf alloys have a low coefficient of friction, good wearing qualities, high tensile strength, high hardness and the ability to withstand heavy pounding. Some of the alloys can be hardened by heat treatment. In the harder grades, these alloys are used for heavy duty service where high compressive loads are encountered and where lubrication may be scant. Present day increases in operating speed of modern machine equipment and the economy of little or no machine "down" time has made Tuf-Stuf popular in the machine tool industry. It is used in a multitude of applications where resistance to wear is important, such as: Drill Jigs, Feed Nuts, Rollers, Cams, Collets, Gibs, Gears, Boring Bar Guides, Lead Screw Nuts and Clutch Shifter Forks. Also, because of their ability to withstand higher stresses and resist season-cracking, these alloys are ideally suited for threaded nuts and bolts and pole-line hardware.

The unusual physical properties of the Tuf-Stuf series have made it particularly useful in the chemical and allied industries. These alloys combine the strength and ductility of medium steel with high resistance to corrosion by many chemicals. Tuf-Stuf alloys will not only resist oxidation at elevated temperatures, but will also retain a greater portion of their strength and hardness at these temperatures than will the copper zinc alloys. These properties make them ideal in the aircraft industry for valve seat inserts, spark plug bushings, valve guides and propeller hub cones.

Tuf-Stuf alloys are supplied as forgings, rod or screw machine products. As forgings the grain structure can be controlled to produce parts that are strongest at points of greatest stress and strain. Relatively intricate shapes can be forged to closer tolerances than sand castings. Where appearance is a factor, a forging may easily prove more economical since a minimum amount of machining, buffing or polishing is required before finishing.

If you'd like more information about this series of alloys, drop me a line or better yet, send me your sample part or blueprint and an explanation of its use and we'll be glad to submit our recommendations.

• **WRITE TODAY FOR THE ENGINEERING MANUAL YOU NEED**

Mueller Brass Co. Forgings Engineering Manual H-58565 ☐

Tuf-Stuf Aluminum Bronze Alloys Engineering Manual H-58563 ☐

600 Series Bearing Alloys Engineering Manual FM-3000 ☐

Copper Base Alloys in Rod Form Engineering Manual FM-3010 ☐

MUELLER BRASS CO.

PORT HURON 35, MICHIGAN

178

NOW...for every production need there's a

Morris

MOR-SPEED

Radial Drill

RUGGED 9"–11" **radial drills**
with centralized controls

Every control in sight, within reach, easy to operate, fumble-free. Rugged construction, massive rigidity. Exceptional balance, plus accurate spindle speed and feed, assures maximum operating precision.

There's a Morris Mor-Speed Radial Drill to satisfy your most exacting specifications. Write for complete detailed information and prices!

THE MORRIS MACHINE TOOL CO.
946 Harriet St., Cincinnati 3, Ohio

NEW 13"–15"
hydrapower radial drills
with preselective settings

The ultimate in drilling speed and operational ease. Hydraulically powered, push button operated features include: head traverse; gear shifting; arm raising, lowering, clamping, unclamping; column and head clamping. Preselection of spindle feeds and speeds while drill is in action.

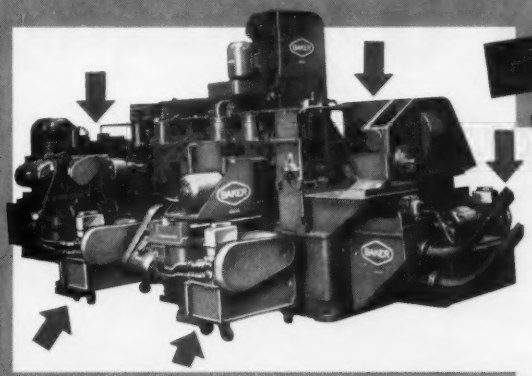
Builders of MOR-SPEED Line

Morris

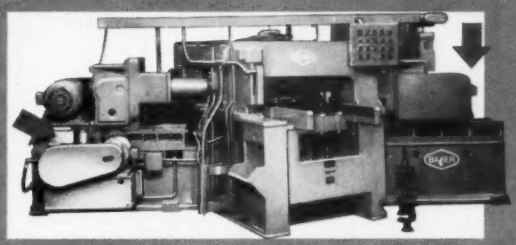
For more information fill in page number on Inquiry Card, on page 241

OILGEAR "JK" FLUID POWER FEED PUMPS

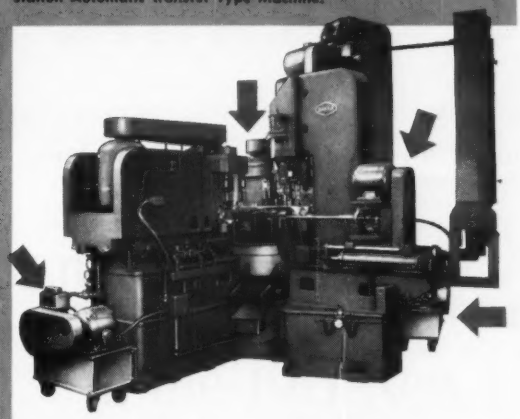
AS APPLIED TO BAKER BROTHERS MACHINES



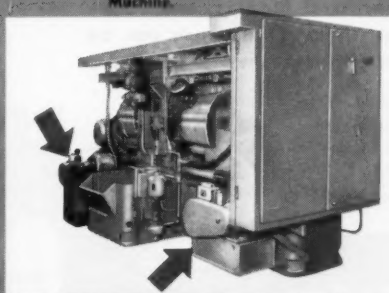
Five Oilgear "JK" Feed Pumps on Baker's Multiple Station Automatic Transfer Type Machine.



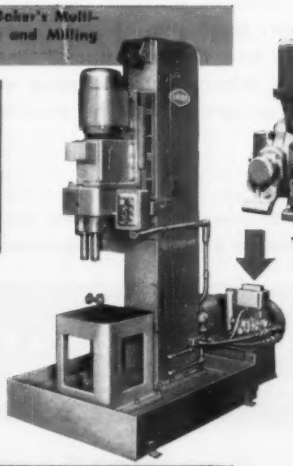
Two Oilgear "JK" Feed Pumps on Baker's Four-Station Automatic Transfer Type Machine.



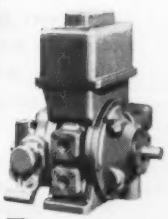
Four Oilgear "JK" Feed Pumps on Baker's Multiple Head Drilling, Boring, Reaming and Milling Machine.



Two Oilgear "JK" Feed Pumps on Baker's Double End Drilling, Boring and Reaming Machine.



Oilgear "JK" Feed Pump on Baker's Double Spindle Vertical Drilling, Boring and Reaming Machine.



Type "JK" Pump Built in four sizes.

HOW CAN YOU USE THESE SIMPLE, VERSATILE, EASILY APPLIED, PROFITABLE UNITS?

Baker Brothers, Inc., pioneers in machine building, users of Oilgear Feed Pumps since 1925, employ Oilgear "JK" Fluid Power Variable Delivery Feed Pumps on a host of machines including the headline-making 100-foot-long transfer machine and their own commercially available portable hydraulic power unit which you can see in photos Nos. 1 and 3 on this page.

The Oilgear "JK" Feed Pump offers many advantages, not the least of which are easy applicability and accessibility. There's no need in many cases for machine redesign and engineering. And this unit does so much to speed cycle time—traverse speed for example can be 265 times feed rate—that production rises dramatically and costs subside. Both coarse and fine feed rates can be varied infinitely so you at once discover the best rates for your work—and the automatic built-in compensator holds the selected fine feed *unvaryingly*. All functions are controlled automatically, semi-automatically or manually.

Evidence of Oilgear "JK" dependability is growing. In one large automotive plant, now 75% changed over to Oilgear, hydraulic maintenance staff was cut from 6 men to one man per shift. In another great automotive plant, the records show Oilgear is found to give the finest service of all.

There's much more to tell especially about two new units added to the "JK" line. Why don't you send for free literature that gives all the facts and figures. So you won't forget, send for it now.

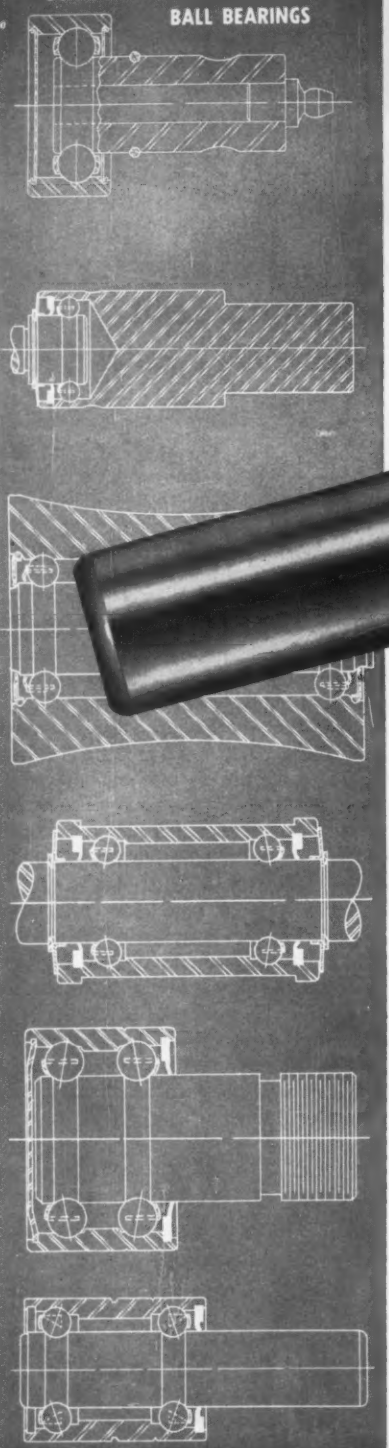
THE OILGEAR COMPANY
1569 W. PIERCE STREET
MILWAUKEE 4, WIS.

OILGEAR
Fluid Power

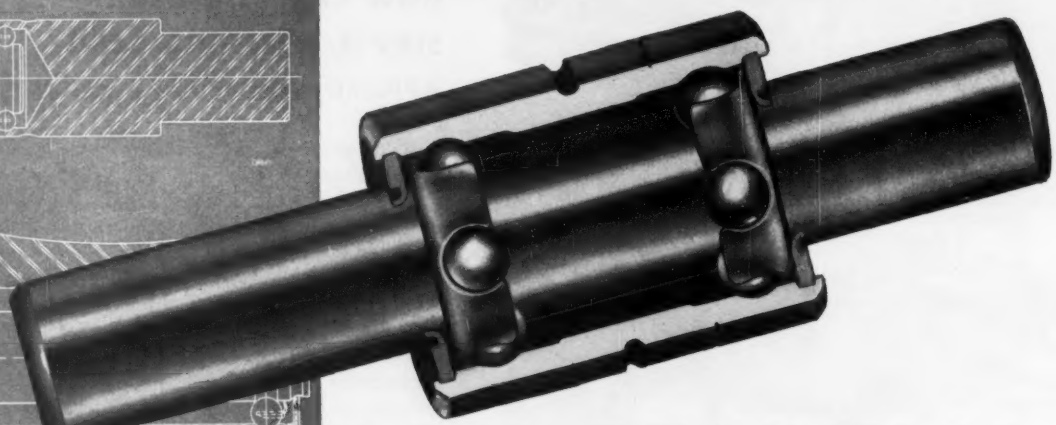
PIONEERS . . . NOW THREE PLANTS FOR FLUID POWER

PUMPS, MOTORS, TRANSMISSIONS, CYLINDERS AND VALVES

SOME M-R-C INTEGRAL SHAFT BALL BEARINGS



M-R-C "Synthe-Seal" INTEGRAL SHAFT



BALL BEARINGS

Reduce manufacturing and maintenance costs—eliminate inner ring and shaft fitting problems.

- Bearings protected against dirt and moisture during installation and use.
- Prelubricated unit assures proper type and amount of grease.
- Cartridge type unit simplifies installation with minimum of parts.

When quantities warrant, bearings can be supplied with shaft extensions having machined holes, grooves, keyways, slots, shoulders and threads, and with pressed flingers, snaprings, collars or other parts mounted on them. Shaft ends can be supplied unhardened to be modified by customer if required.

M-R-C Engineers are available for consultation on your bearing problems.

M-R-C Strom SRB Gurney Ball Bearings

MARLIN-ROCKWELL CORPORATION

Executive Offices: JAMESTOWN, NEW YORK

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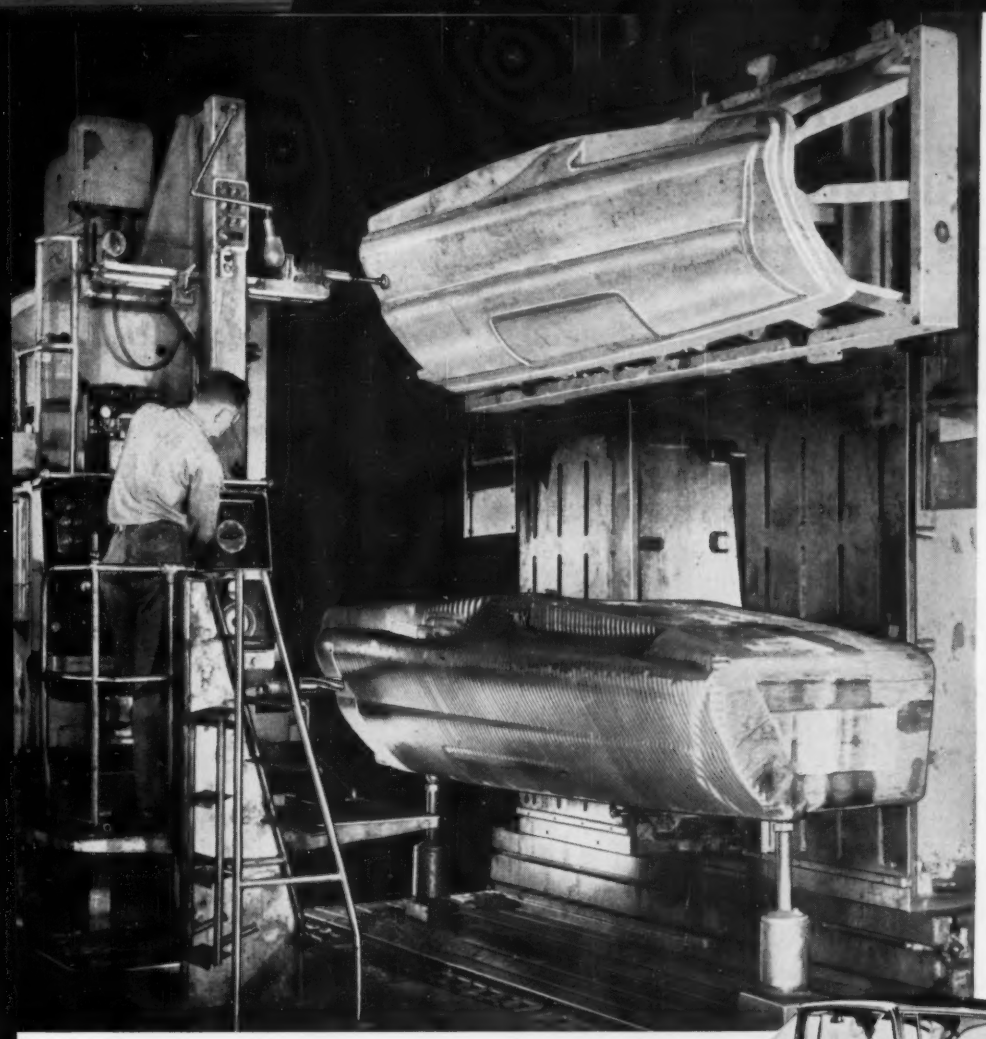
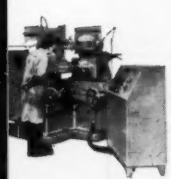


Helps put the "B-G" in the BiG New 1956 LINCOLN

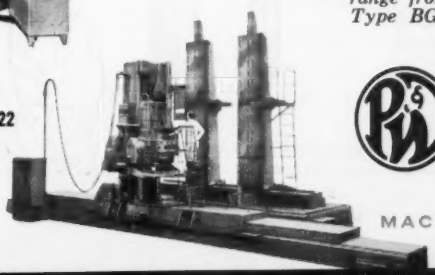
. . . the PRATT & WHITNEY KELLER Type BG-22

Hallmark of Lincoln styling is a distinguished, lithe, trim look with gracefully flowing lines. Producing the huge dies that faithfully translate the designer's drawing board dream into a reality of smoothly formed metal is just one of the jobs done so well by Pratt & Whitney Keller Automatic Tracer-Controlled Milling Machines. Shown here is a big Keller Type BG-22. Following a plaster model, it sculptures the complex contours of a rear quarter panel in solid metal . . . quickly, exactly and, above all, economically.



SMALL . . . or LARGE

There's the right size Keller Machine for every plant, for every job. Capacities range from 36" x 20" (for the compact Type BL) to 20' x 7' (for the giant Type BG-22). Write for complete information outlining your requirements.



TYPE BL

TYPE BG-22

PRATT & WHITNEY COMPANY
INCORPORATED

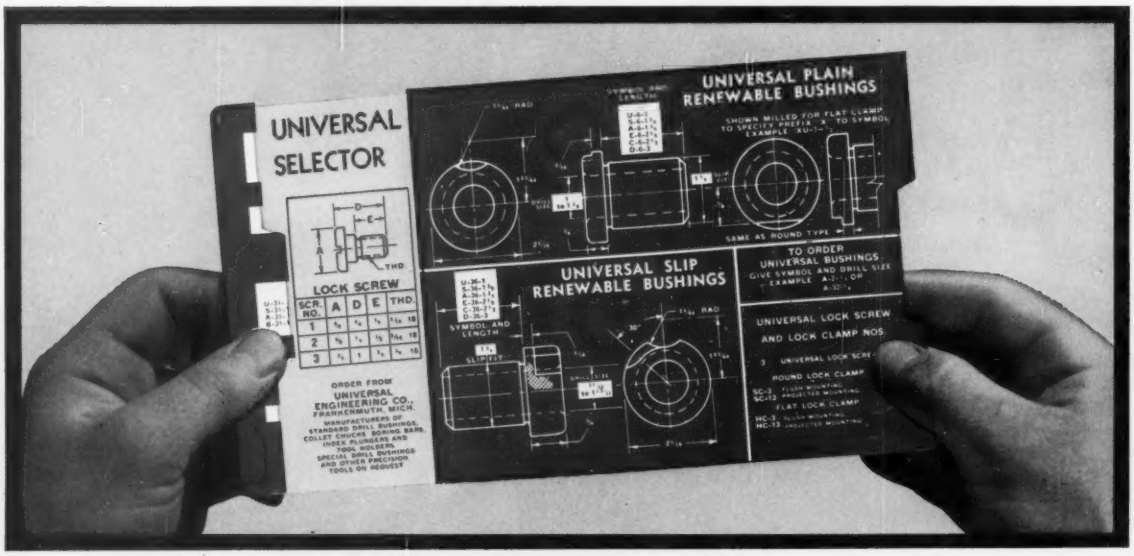
12 Charter Oak Boulevard, West Hartford 1, Connecticut

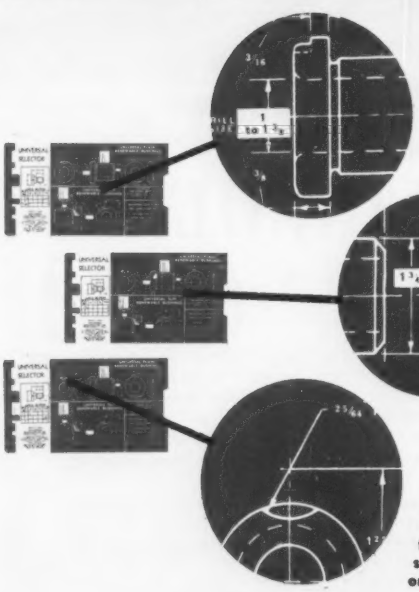
Direct Factory Representatives in Principal Cities

MACHINE TOOLS • GAGES • CUTTING TOOLS

HOW THE UNIVERSAL DRILL BUSHING SLIDE CHART SIMPLIFIES JIG DESIGN

new plastic, pocket-size calculator gives all engineering data for the selection of all types and sizes of drill jig bushings up to 1¾" drill size


UNIVERSAL SELECTOR
UNIVERSAL PLAIN RENEWABLE BUSHINGS
UNIVERSAL SLIP RENEWABLE BUSHINGS
TO ORDER UNIVERSAL BUSHINGS
UNIVERSAL LOCK SCREW AND LOCK CLAMP NOS.
LOCK SCREW
ORDER FROM UNIVERSAL ENGINEERING CO. FRANKENMUTH, MICH.



The SELECTOR is divided into four areas, one for each of the four types of bushings. The example shown here is for the plain renewable. Using this area, you move the slide until the correct drill size appears in the drill-size window.

Once the drill size is set up on the SELECTOR, all other factors now appear in the windows. This section, for example (shown actual size) shows correct bushing O.D. and dimension from center to flat for clamp.

This section shows the radius for lock screw. Every factor you need for drill bushing jig design as well as for ordering the correct bushing to fit that design is shown correctly, exactly, and at a glance on the SELECTOR.

A new service to regular users of drill jig bushings is this extremely practical plastic Selector slide-chart. When designing jigs, you will save many hours, and be certain of your accuracy, with the SELECTOR. It represents the result of six years experimentation and research by Universal Engineering Co. If you are an engineer specifying bushings and do not have one of these slide calculators—you can have one for your own design work by simply requesting it on your company letterhead. Don't wait—do it today!

193

UNIVERSAL ENGINEERING CO. FRANKENMUTH 2, MICHIGAN

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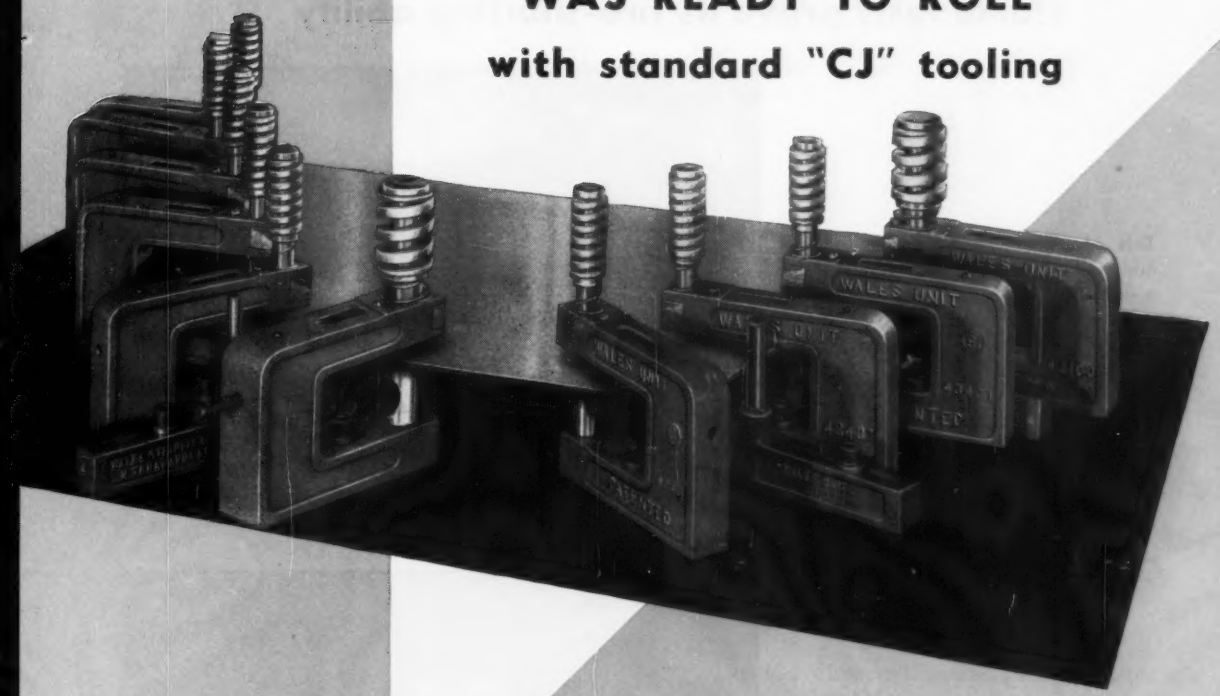
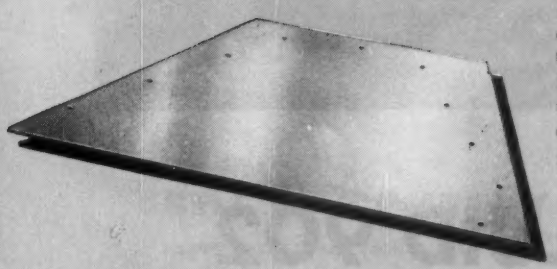
6 minutes . . . 45 seconds
and this ten hole

WALES PUNCH SET-UP

WAS READY TO ROLL
with standard "CJ" tooling



HERE'S THE RESULT EVERY 12 SECONDS



. . . and any good mechanic can make a similar set-up in a matter of minutes. WALES *standardized punching units* are completely self-contained . . . punches and dies are permanently aligned . . . nothing attached to press ram. They will always save hours . . . and often DAYS in set-up time.

Rugged type CJ units will punch holes up to 1¼" diameter in material up to ¼" thick . . . unlimited straight line, scattered and staggered, round or shaped hole punching patterns. Die retention design features rapid die change WITHOUT REMOVING DIE from set-up . . . provides controlled slug ejection.

No "dead storage" the WALES WAY! The same group of units can be used *over* and *over* again in other patterns.

Get this time-saving, money-saving story. Write for fully illustrated, fact filled catalog. NOW!

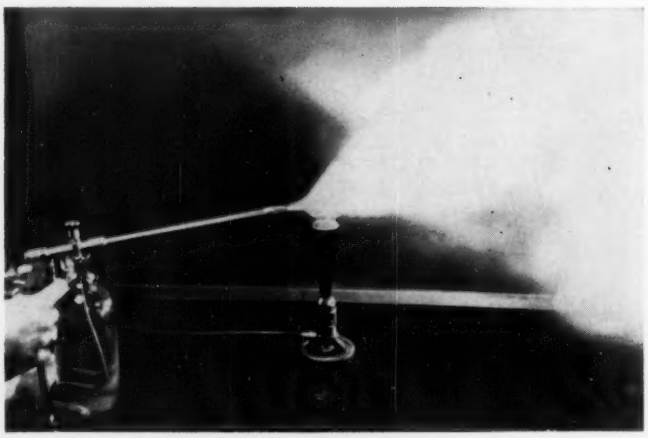
Send for BULLETIN NO. 15G
Illustrated with actual job work and full of interesting data and suggestions that you can adopt for your shop.

WALES *Strippit* CORPORATION
"...the Wales-Way is the PLUS-PROFIT way"
345 PAYNE AVE. — North Tonawanda, N.Y.
WALES-STRIPPIT OF CANADA LTD., HAMILTON, ONT.

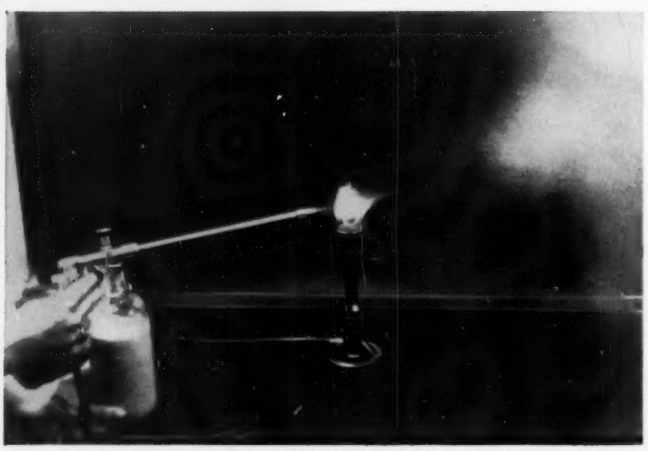
Announcing...the First

HYDRAULIC

Flame tests prove its fire-snuffing ability



This photo shows the instant combustion taking place when a conventional hydraulic oil of mineral oil type is atomized over a Bunsen burner.



In this photo, Shell Irus Fluid 902 replaces the mineral oil. Note that there is no ignition.

SHELL IRUS FLUID 902

Oil-Base fire-resistant FLUID

SHELL IRUS FLUID 902

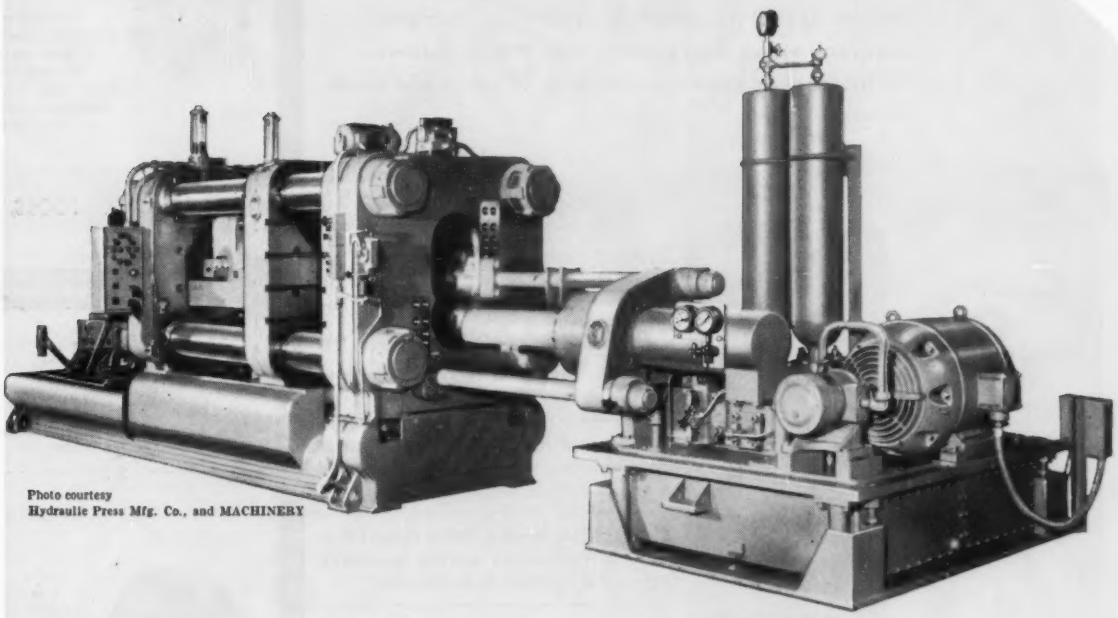


Photo courtesy
Hydraulic Press Mfg. Co., and MACHINERY

AFTER THREE YEARS of intensive research, field application and evaluation, Shell Irus Fluid 902 is now commercially available for use in industrial hydraulic systems. While its cost is far lower than other fire-resistant fluids, its performance is comparable.

No major modification of equipment is necessary. Shell Irus Fluid 902 is a special formulation containing no corrosive ingredients . . . no adverse effect on seals or fittings. It is a direct replacement for hydraulic oils now in service.

Noncorrosive, and nonrusting. Steel and copper panels immersed in Irus Fluid 902 for one week at 160°F have shown no significant signs of corrosion. Rusting has not been a problem in long-continued field tests.

This is an efficient fire-snuffing hydraulic fluid that can be widely used. Send coupon for details.

SHELL OIL COMPANY

50 WEST 50 STREET, NEW YORK 20, NEW YORK

100 BUSH STREET, SAN FRANCISCO 6, CALIFORNIA

SHELL

SHELL OIL COMPANY
50 West 50th St. or 100 Bush St.
New York 20, N. Y. San Francisco 6, Cal.

Please send me test data and information on Shell Irus Fluid 902.

Name_____

Company_____

Address_____

_____

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Scully-Jones

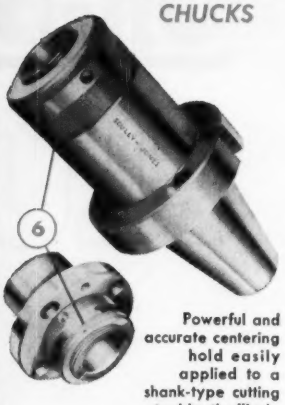
PREMIUM ACCURACY CHUCKING TOOLS

pay for themselves fast

Unique operating principle brings you extreme accuracy along with tremendous holding power for internal or external chucking of parts and tools

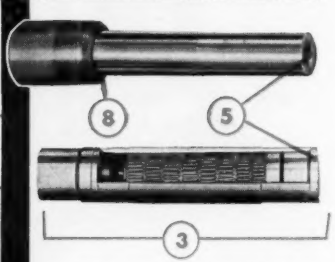
These benefits	. . for these reasons	. . . result from these PREMIUM features
INCREASED ACCURACY	Run-out is often less than .0001 in.	1. Equal force is evenly applied all around the chucking surface, eliminating all play and accurately centering the part or tool.
		2. Rollers are selected to tolerances of ± .00004 in.
		3. Parts are made of tool steel carefully heat-treated and precision-ground to a high surface finish.
INCREASED PRODUCTION	Reduce loading and unloading time	4. Very little turning force required to produce tremendous holding pressures. Only rolling friction to overcome.
		5. Accurate centering hold or shrink fit easily applied by twisting the actuating cone. Powerful wedging action expands chucking surface . . . no arbor presses or hammering required. Hold or fit is easily disengaged.
	Speed tool changes	6. Powerful, accurate centering fit easily applied to shank-type cutting tool by twisting the actuating ring.
	Speed operations	7. Extreme rigidity and tremendous holding power permit use of heavier feeds at higher speeds.
		8. Pieceparts are always easy to load in the same position due to the simple and accurate method of locating and chucking.

NEW "BETTER-HOLD" CHUCKS

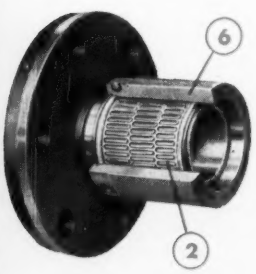


Powerful and accurate centering hold easily applied to a shank-type cutting tool by the "lock-and-eject" collet.

"ROLL-LOCK" TOOLS

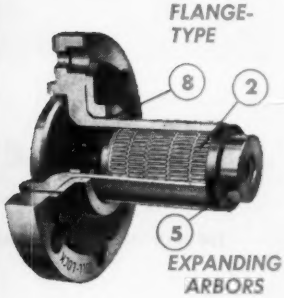


EXPANDING MANDRELS



FLANGE-TYPE CHUCKS

FLANGE-TYPE



EXPANDING ARBORS

SCULLY JONES

Call your Scully-Jones factory-trained representative or distributor for complete information and prices.

PRECISION HOLDING TOOLS

"Precision Holding" for holding precision

Scully-Jones and Company, 1906 South Rockwell St., Chicago 8, Ill.

A **WADELL** FEATURE

vertical design
Precision Boring Machine

EASIER TO OPERATE

The machine table is in the natural position providing convenient handling of work pieces.

SIMPLIFIES TOOLING

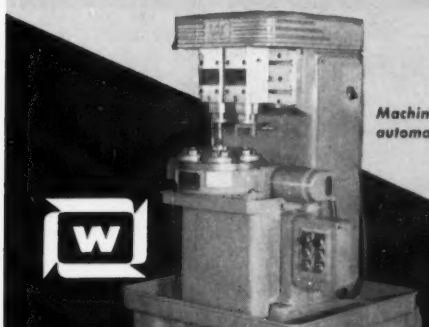
In the majority of cases, the Wadell VBM eliminates the need for angle plates and other means of orienting work pieces. Setting up and locating of fixtures is obviously simplified.

ADAPTABLE TO AUTOMATIC OPERATION

This machine equipped with the Wadell Precision Automatic Indexing Table, another standard Wadell machine component, provides high production potential. Chute loading and completely automatic set-ups are simpler and more economical.

Send your parts prints to Wadell and get complete "PRODUCTION PACKAGE" cost.

GREGORY RUFFA ADVERTISING



Machine illustrated with automatic indexing table completely tooled.

WADELL

EQUIPMENT COMPANY

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for further information contact the dealer nearest you

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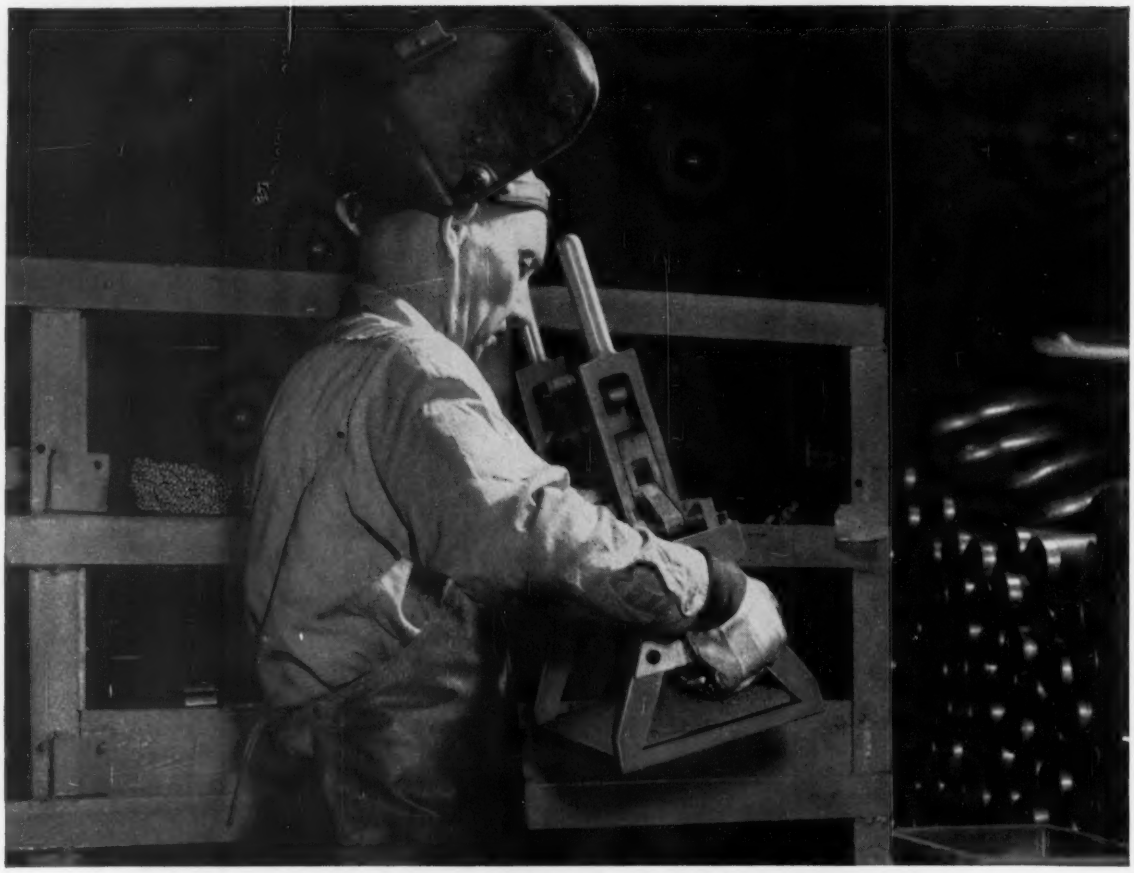
Made with MAGNESIUM

DOW



A FEW POUNDS make a big difference when jigs have to be moved manually several times an hour.

MAGNESIUM FOR LOW-COST TOOLING

Lightweight magnesium tooling plate costs less to buy, less to fabricate and less to use

• **COSTS LESS TO BUY**—Jigs and fixtures made with magnesium cost you less in every way. Magnesium tooling plate costs less than commonly used lightweight tooling materials.

• **COSTS LESS TO FABRICATE**—Magnesium jigs and fixtures are easy and economical to build, too. The reason is that magnesium tooling plate is easy to machine, easy to weld. It has guaranteed flatness, excellent dimensional stability and freedom from porosity.

• **COSTS LESS TO USE**—Handling costs are also lower when you use magnesium tooling plate. Magnesium weighs one fourth as much as steel and only two thirds the weight of aluminum. By making your jigs and fixtures with lightweight magnesium you'll increase worker efficiency and reduce lost-time injuries.

For more information about magnesium tooling plate contact your nearest supplier of Dow magnesium, or write THE DOW CHEMICAL COMPANY, Midland, Michigan, Dept. MA 371CC.

AVAILABLE FROM STOCK AT: Copper and Brass Sales, Inc., Detroit, Mich. • Fullerton Steel and Wire Company, Chicago, Ill. • Hubbell Metals Inc., St. Louis, Mo. • A. R. Purdy Co., Inc., Lyndhurst, N. J. • Reliance Magnesium Company, Los Angeles, Calif. • Vinson Steel and Aluminum Co., Dallas, Texas.

you can depend on DOW MAGNESIUM DOW

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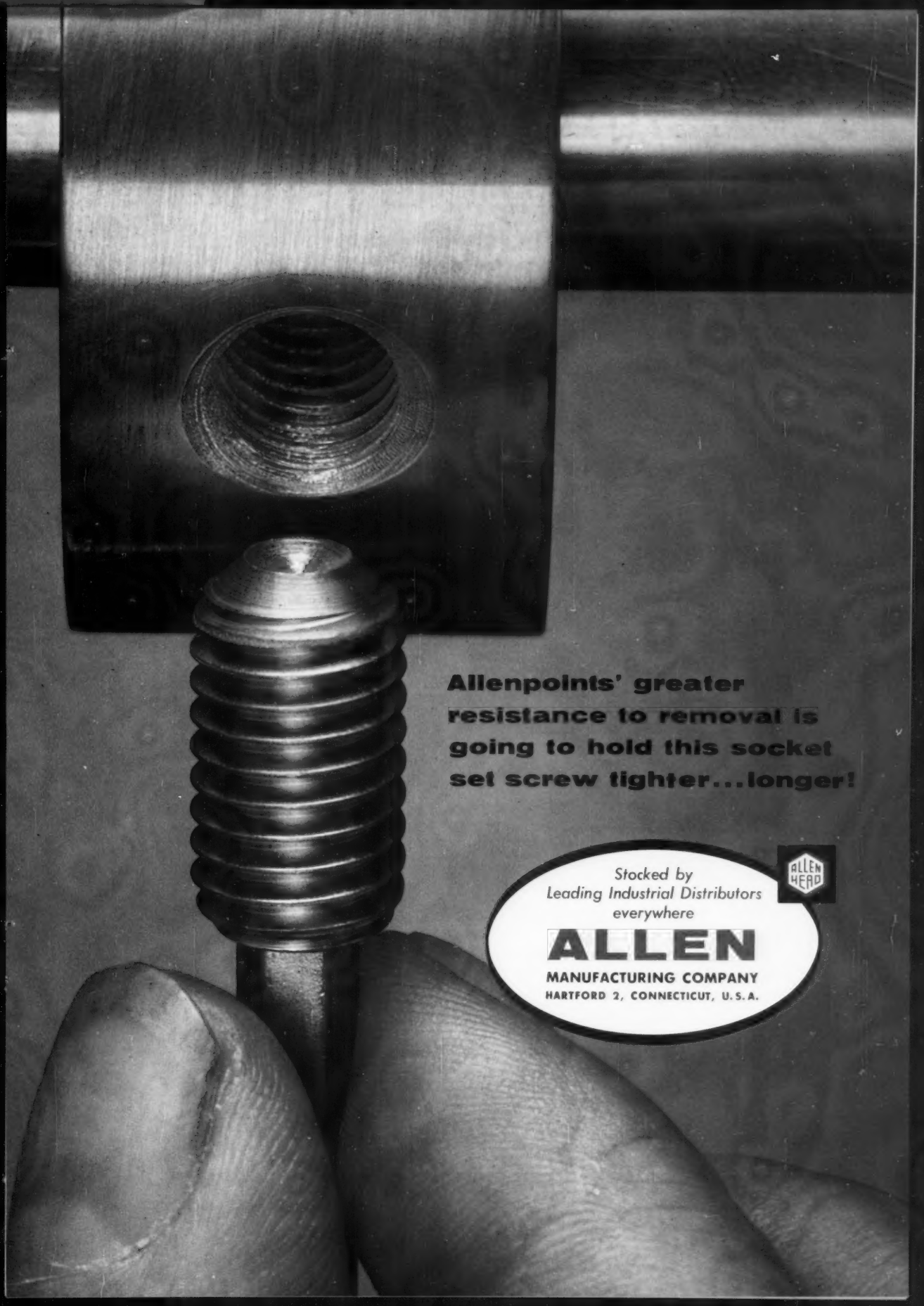
Allenpoints' greater resistance to removal is going to hold this socket set screw tighter...longer!
Stocked by Leading Industrial Distributors everywhere
ALLEN
MANUFACTURING COMPANY
HARTFORD 2, CONNECTICUT, U.S.A.
ALLEN HEAD

Drill and cut with accuracy . . .

hold with a *Jacobs* CHUCK

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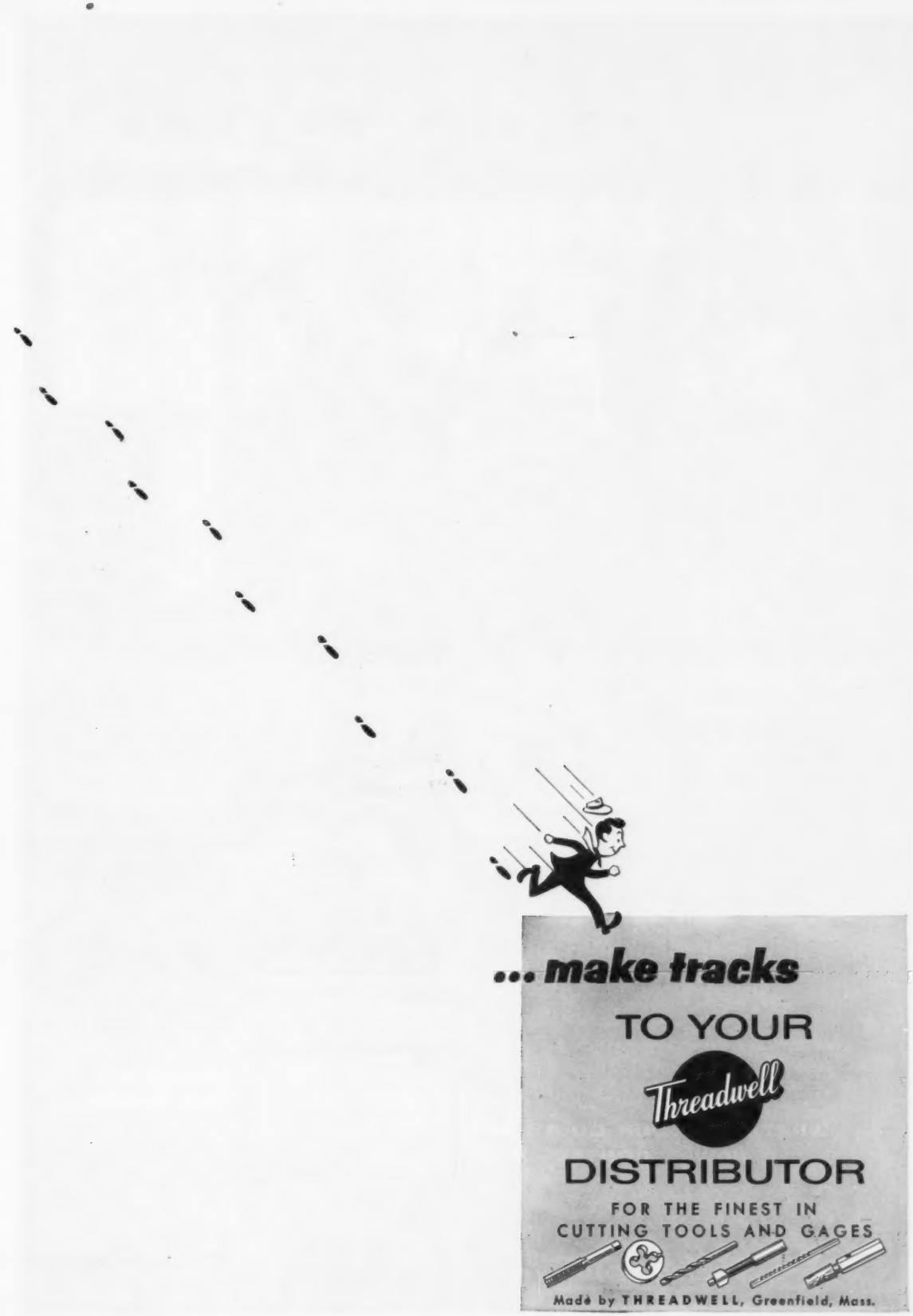
THE JACOBS MANUFACTURING COMPANY • WEST HARTFORD, CONNECTICUT



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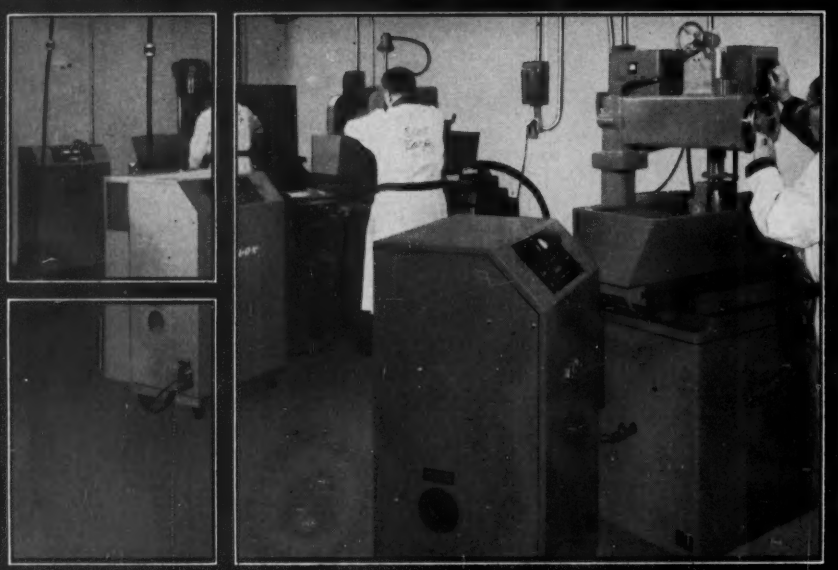
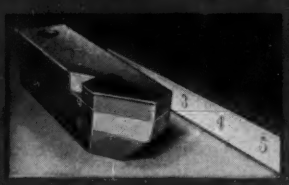
a room with a view

TO THE FUTURE

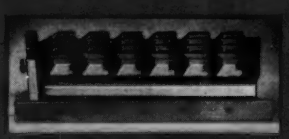


This is the Elox "Demo Room". The demonstration center where we prove that the machining of jobs formerly difficult or impossible can be done with ease and economy by Electrical Discharge Machining.

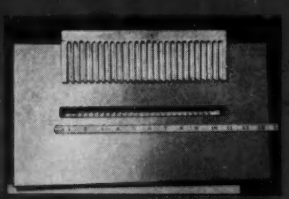
This "proof division" at Elox will run not just a few samples for you but enough quantity production to provide a real evaluation of how Elox E.D.M. can save time and money in your plant. Tungsten carbide tipped single point tools, forging dies, die casting dies and tungsten carbide form tools will be machined at a cost we guarantee cannot be duplicated by any other method. Make use of our Elox "Demo Room". It has proven to hundreds of alert firms that these jobs can be done better, faster, less expensively.



WE SAVED 19 MINUTES grinding this single point tungsten carbide tip boring tool.



WE SAVED 16 HOURS plus 7 different operations on this form grinding of a carbide broach.



WE SAVED 379 HOURS on the machining of this die casting die.

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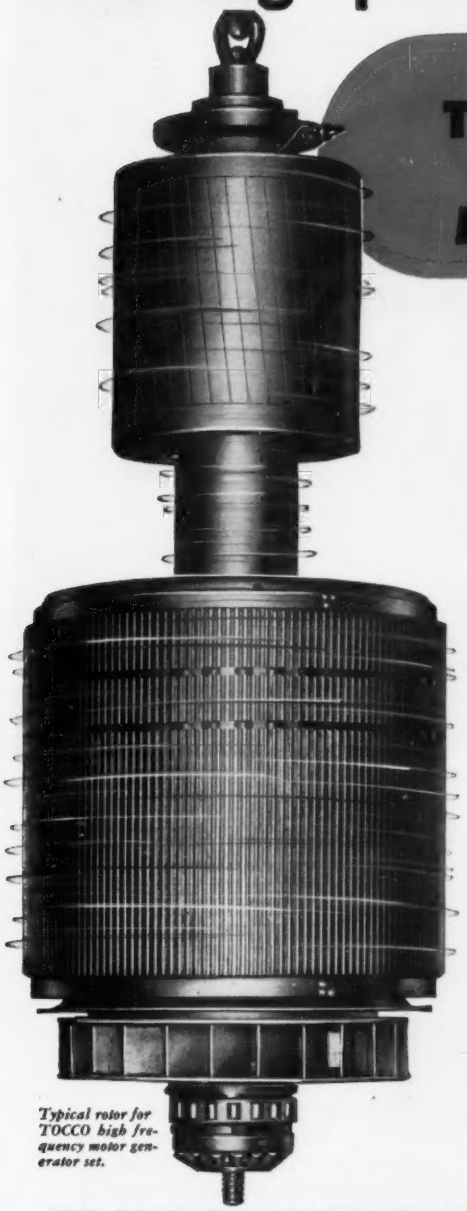

Typical rotor for TOCCO high frequency motor generator set.

First with Vertical MG Sets—TOCCO

In 1943 TOCCO designed and built the first vertical motor-generator sets for furnishing hi-frequency power for induction heating applications. Now with thirteen years of continuous production experience, we are far and away the world's largest supplier of these units.

Advantages of TOCCO Vertical MG Sets

The large TOCCO vertical type motor generator set has numerous advantages over conventional horizontal type sets. Vertical construction permits the use of very large bearings and also minimizes the hazard of major damage to the set in the unlikely event of a bearing failure. Longer bearing life is achieved due to lower pressure and uniform loading of the bearings. Maintenance is greatly simplified because the rotor can be removed vertically with a simple hoist. Anti-vibration mountings between the base and the MG rotor-stator assembly practically eliminate vibration. No special foundations are needed. Lastly, TOCCO's vertical design cuts necessary floor space to less than one-half the area required by horizontal motor-generator sets.

TOCCO Vertical MG sets are available in sizes up to 350 KW and frequencies from 1000 to 10,000 c.p.s.

Only Time-Tested Vertical MG Sets—TOCCO

There are over a thousand TOCCO vertical MG sets in actual service TODAY—more than all competitive horizontal makes combined. Write us for descriptive bulletin giving full details on the advantages and construction details of TOCCO Vertical MG Sets.

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TOCCO

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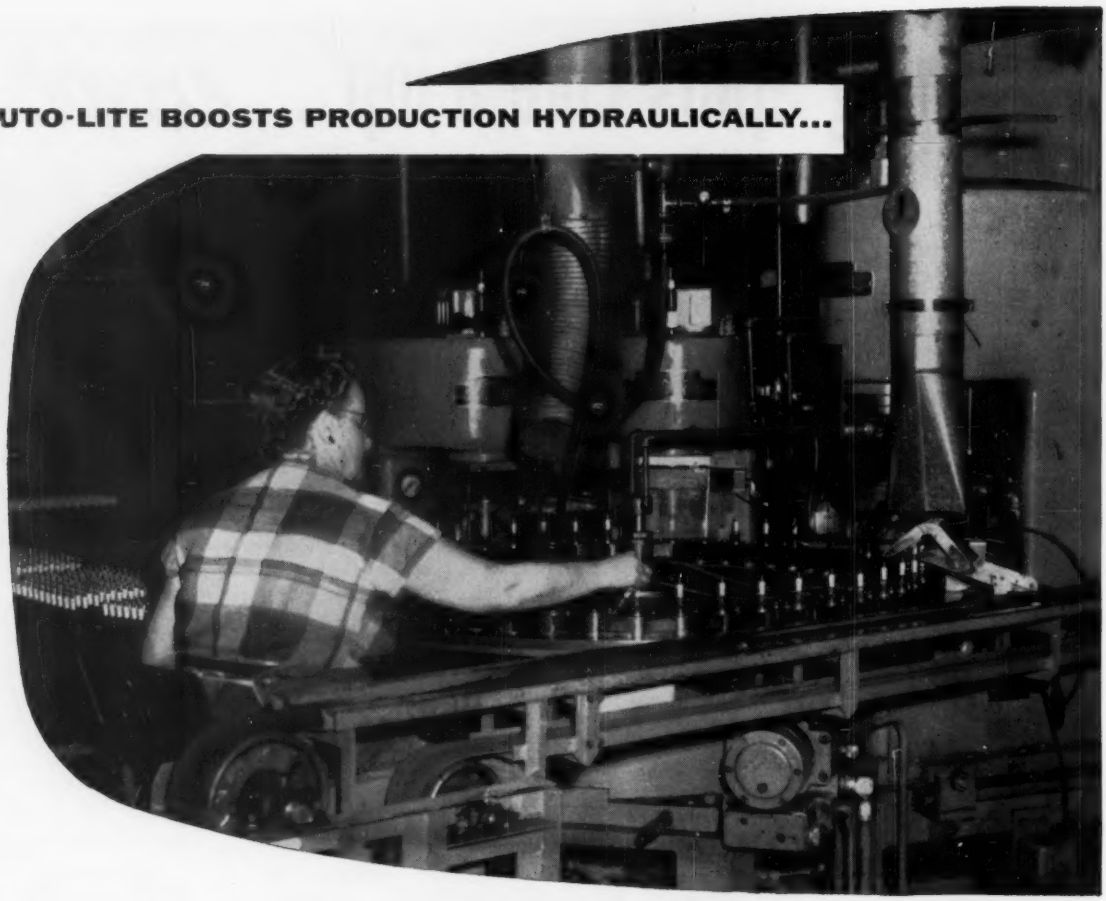
AUTO-LITE BOOSTS PRODUCTION HYDRAULICALLY...



MULTIPRESS® installation automates assembly operations

- ★ **Sets new safety levels**
- ★ **Reduces tool and die costs, eliminates down-time**
- ★ **Improves product quality, provides for future expansion**

The installation of seven 48-station Multipresses at the Fostoria, Ohio, plant of Electric Auto-Lite has introduced added efficiency into a critical production stage — final assembly of spark plugs.

One unit with a single operator (1) pre-presses the top gasket of a spark plug to centralize the insulator within the shell; (2) cold forms the shell to anchor the entire sub-assembly as an integral unit; and (3) seals the shell and insulator. These operations had required *three individually operated presses.*

Since Multipress equipment was installed, materials handling has been reduced and tool and die costs cut substantially. Down-time has been virtually eliminated; maintenance can be carried on without interrupting production. Exact control over force application is now possible, with improved product quality control a direct result.

The experience of Auto-Lite is typical of hundreds of companies who have found that a Denison Multipress, with its automatically controlled hydraulic ram, can produce a better product... faster, more efficiently, and at less cost. Write for complete details.

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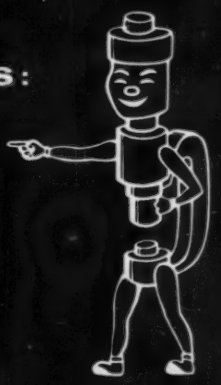
PRECISION PETE SAYS:

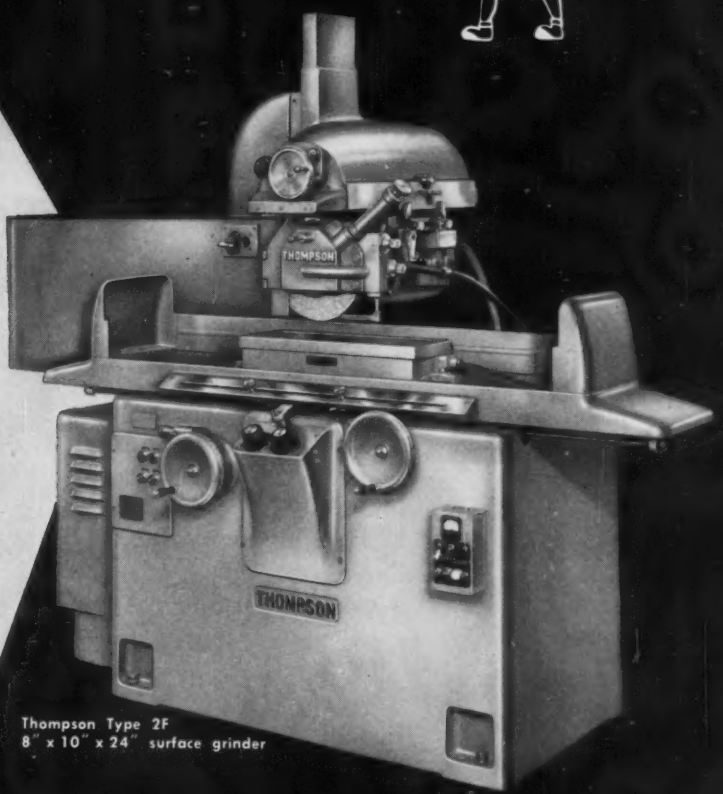


Only Thompson Type 2F Grinder has all three available . . .

1 COOLANT THRU THE WHEEL . . .

2 . . . COOLANT EXTERNALLY ON THE WORK . . .

3 . . . AND "IN POSITION" WHEEL TRUING



Thompson Type 2F
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Operation *AUTOMETROLOGY

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- Greatly increase the production rate of dimensionally acceptable bearings.

This and all other automation projects are handled by Sheffield's Research Division. Sheffield has the over-all experience and the skilled technicians to make automation productive for you. Let Sheffield engineers help plan your automation project. Call the Sheffield Corporation, Dayton 1, Ohio, U.S.A., Dept. 6.

**AUTOMETROLOGY*—The single or multiple combination of machining, motion or memory with automatic measurement.*

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manufacture and measurement for mankind

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MACHINE OF THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. "THE So-swing PEOPLE" SENECA FALLS, NEW YORK

SENECA FALLS MODEL "LN" LATHE IS EQUIPPED AND AUTOMATED FOR SPECIALIZED PRODUCTION JOB

Seneca Falls Model "LN" Automatic Lathe designed with standardized units including a "PACKAGED" automatic loader and ejector mechanism.

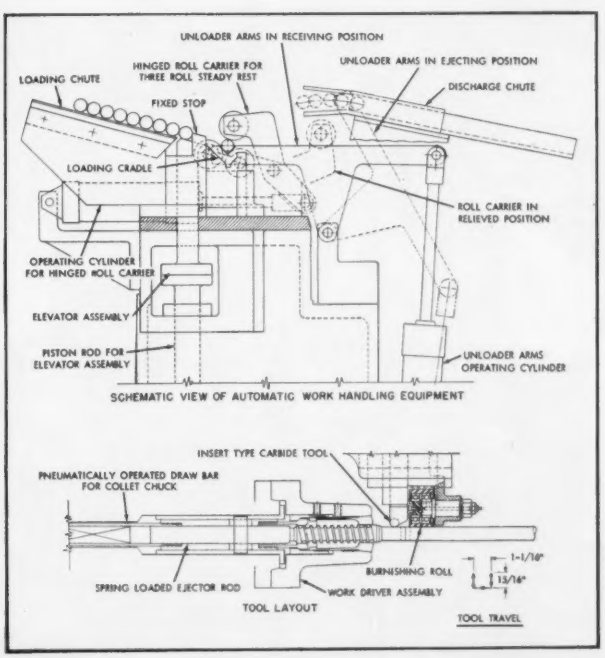
PROBLEM: To remove welding flash from worn shaft assemblies on a high-production basis.

SOLUTION: A Seneca Falls Model "LN" Automatic Lathe was equipped with certain standardized units to provide a specialized high-production machine at substantial savings in initial cost and lead time.

Red hot welded parts are delivered by a conveyor, which joins the loading chute shown in the line drawing illustrating the automatic work handling equipment. The work piece is held and driven in a collet chuck and supported by a hinged three-roll steady rest. A carbide tool on an overhead slide removes the hot flash and is followed by a burnishing roll which smoothes the junction of the welded parts.

The entire loading, machining and unloading operations are entirely automatic; however, push button controls are installed for the manual operation of each movement. The loading cycle cannot get out of time since the automatic sequence is controlled by a system in which each movement is initiated by the completion of the preceding movement. A production of 275 pieces per hour is readily obtained with this equipment.

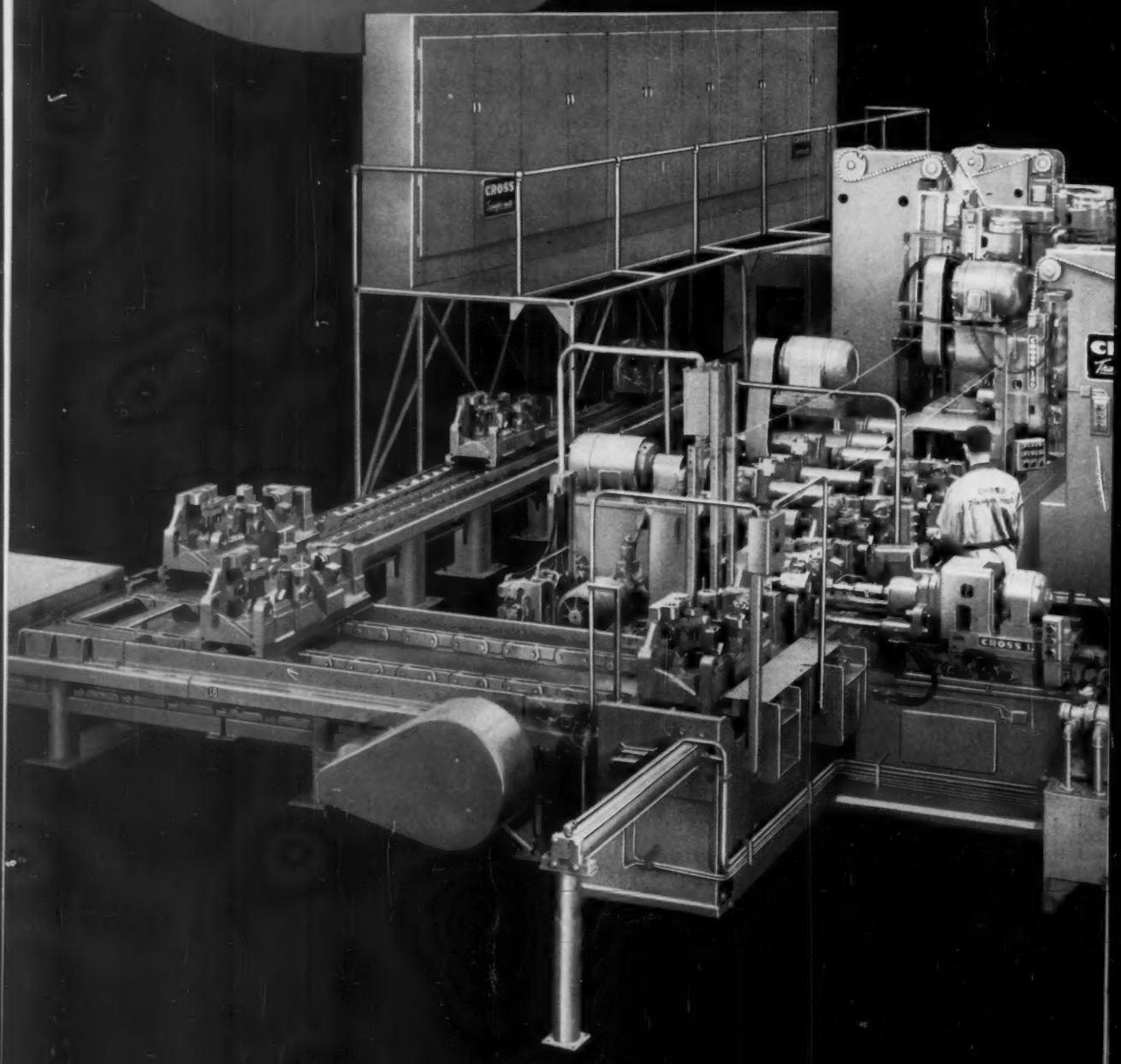
SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.



PROFIT ENGINEERED BY SENECA FALLS

Completely Machines Power Steering Housings

Another Transfer-matic by Cross



- ★ 156 pieces per hour at 100% efficiency.
- ★ 13 stations: 2 for loading and unloading and 11 for boring, drilling, tapping and burnishing.
- ★ Two-position, progressive type, palletized work holding fixtures for carrying parts from station to station.
- ★ Multiple spindle power wrenches to automatically clamp and unclamp work holding fixtures.
- ★ All parts in Cross machines—even tooling details—are made to interchangeable tolerances for fast, easy maintenance.
- ★ Other features: Construction to JIC standards; hardened and ground ways; hydraulic feed and rapid traverse for milling, drilling, boring; individual screw feed for tapping; automatic lubrication.

Established 1898

THE CROSS CO

First in Automation

DETROIT 7, MICHIGAN

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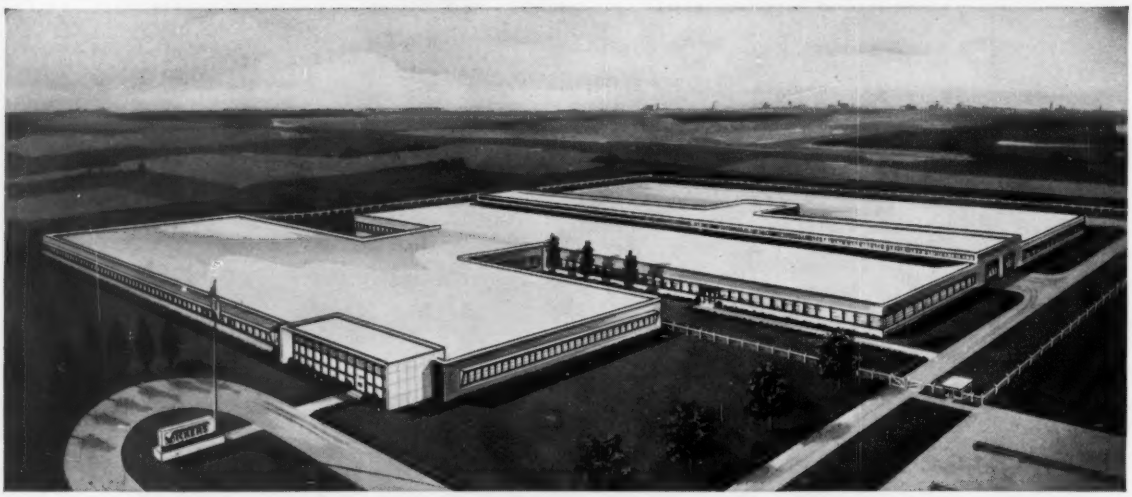
NEW ADMINISTRATIVE and ENGINEERING CENTER



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Vickers, a pioneer in oil hydraulics for a wide variety of uses, has maintained leadership through the years by means of aggressive and extensive research.

Continuing rapid expansion of the oil hydraulics requirements of industry has brought with it the need for augmented research and engineering facilities. To meet this need, Vickers has just completed this new building in suburban Detroit . . . 150,000 square feet devoted entirely to research, development, engineering application and administration.

A milestone in Vickers progress, this new Administrative and Engineering Center is also a promise of future benefits to users of Vickers hydraulic components and systems.

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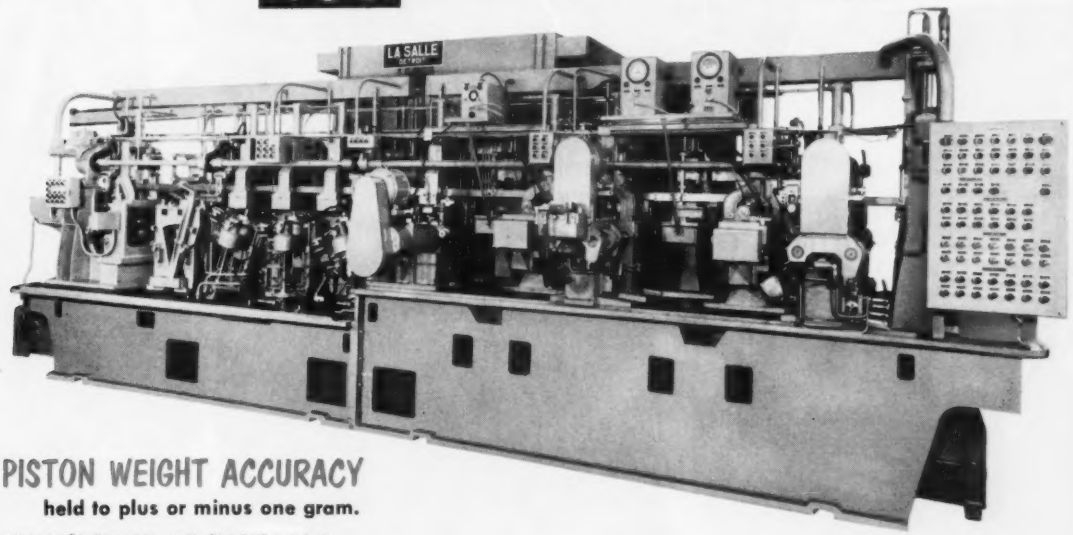
Engineers and Builders of Oil Hydraulic Equipment Since 1921

La Salle AUTOMATED PISTON LINE

PRODUCES 400 PISTONS PER HOUR



PISTON WEIGHT ACCURACY
held to plus or minus one gram.

MACHINE IS ADJUSTABLE
handles different size pistons, with a few relatively simple adjustments.

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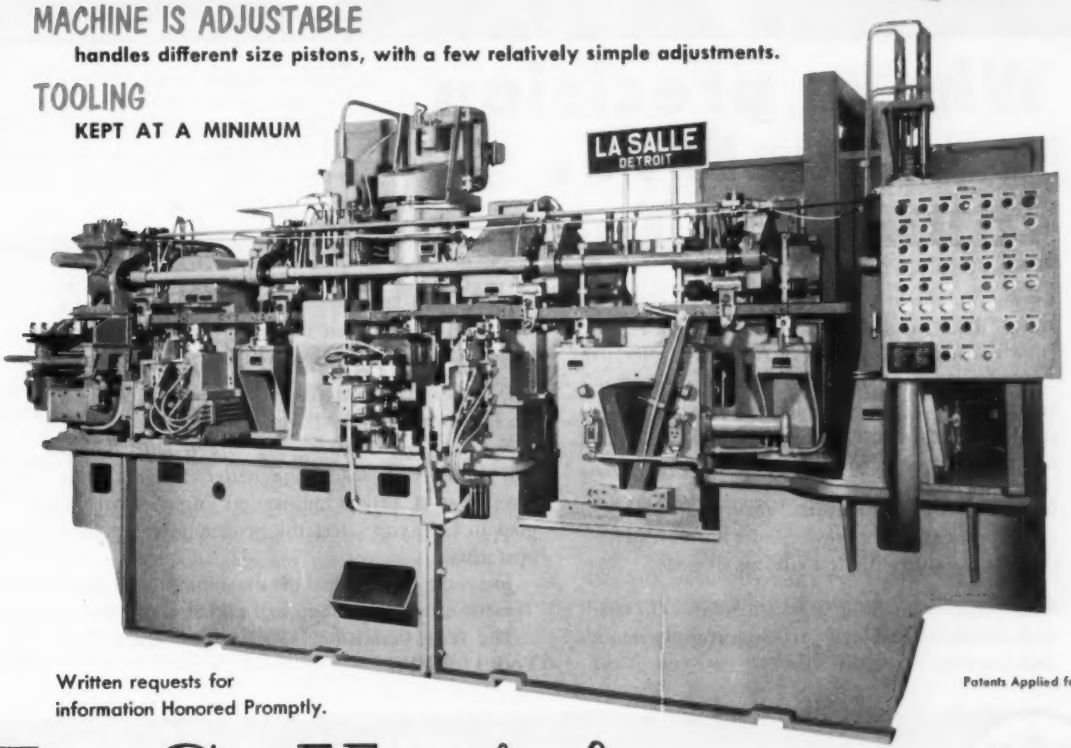
KEPT AT A MINIMUM



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Patents Applied for.

La Salle tool, inc.

ENGINEERING & BUILDING SPECIAL MACHINERY

3840 EAST OUTER DRIVE • DETROIT 34, MICHIGAN

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Where precision counts . . . count on Texaco

Typical machining operation at Cummins Engine Company, Columbus, Indiana. An emulsion of *Texaco Soluble Oil CX* is used here, and has proved highly satisfactory in assuring efficient, low-cost production.

In machining parts for the famous Cummins high speed, light weight diesel engines, tolerances are close, finish must be perfect, rust cannot be tolerated. So it is significant that Texaco supplies cutting fluids for this work. For example, where a soluble oil emulsion is needed, Cummins uses *Texaco Soluble Oil CX* and consistently enjoys these benefits:

More Stable Emulsions: *Texaco Soluble Oil* emulsions remain stable even under the most adverse conditions, assure highest cutting efficiency.

Rust-Free Finish: With a *Texaco Soluble Oil* emulsion, finish on machined parts is uniformly smooth and rust-free.

Longer Tool Life: *Texaco Soluble Oil* emulsions effectively reduce wear on tools, keep them sharp for extra-long periods between regrindings.

Operators everywhere get similar results when Texaco is on the job. There is a complete line of *Texaco Cutting, Grinding and Soluble Oils* to help you do all your machining better, faster and at lower cost. A Texaco Lubrication Engineer will be glad to help you select the proper ones for your operation.

Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

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- Congress asked to tool up
- Symposium forecasts prosperity
- Washington cuttings

Keeping up with Washington

By Loring F. Overman

CONGRESS has again been told that it should do something about machine tools for the Armed Services. This time, the Senate Small Business Subcommittee headed by John Sparkman (D-Ala.) submitted a report charging the government with failing to take all necessary steps to prepare the machine tool industry for its national defense role in the event of an emergency. The report classified a healthy machine tool industry as "a defense asset of highest order" and suggested seven specific steps for improving the government's approach to the machine tool program:

1. Defense Department's announced policy for instituting and maintaining annual machine tool replacement program should be expedited.

2. Budgetary aspects of machine tool programming must be closely watched by Department of Defense officials.

3. Machine tool budgets of each service should be submitted to Defense Secretary and consolidated. D.O.D., O.D.M., and Congress could then evaluate adequacy of the service programs.

4. Defense officials should review Vance Committee recommendations for mobilization reserve of machine tools and related production equipment.

5. In addition to modernization programs and the procurement of general-purpose tools, Defense Department should outline probable needs for special machine tools.

6. Department of Defense and each military department should push to complete machine tool inventory program.

7. Government leasing policy should be reviewed to establish fair rental rates which would not adversely affect the competitive position of small firms.

"Your committee is shocked," said the report, "to find that less than $15,000,000 has been obligated to carry out the Vance recommendations for the creation of a mobilization reserve of machine tools." The committee charged that "results have been virtually nonexistent" when compared with the Vance Committee findings that $600,000,000 to $1,500,000,000 should be spent.

Symposium Forecasts Prosperity

The consensus of a recent business forecast symposium sponsored by the U. S. Chamber of Commerce is that with the exception of automobiles and lower cost housing all segments of the business community report a favorable outlook for the last half of 1956.

Speaking for the Machinery and Allied Products Institute, George Terborg, Research Director, observed:

"Business capital goods constitutes at present one of the strong factors of the economy. Latest Commerce-SEC survey of capital expenditure expectations indicates a 6 per cent rise in seasonally adjusted expenditures from second to third quarters.

"Prospects for the second half of 1956 are excellent. However, industry is a sensitive and volatile facet of the economy, and changes could come fast. See no great chance of downtrend unless tight money market curtails expected expenditures on part of customers."

Washington Cuttings

Commerce Department was reported in mid-June to be planning to recommend a $300,000,000 expansion of the metalworking industry. Purpose, to ready the industry for adequate production in case of emergency. Some of the Commerce Department plans are said to be in anticipation of increasing need for machines to handle thin stainless steel or titanium sheets to be required about 1960 for supersonic aircraft.

Installation of a 14,000-ton extrusion press, at a cost of $9,000,000 for the press and supporting facilities, is planned by Alcoa's Lafayette, Ind., plant. This company is already operating a similar German press which handles ribbed wing sections, spars, rotors for large helicopters, and structural shapes up to 110 feet in length and weighing as much as 2600 pounds.

Milling of titanium by chemical etching is being accomplished in a pilot plant operated at Los Angeles, Calif., by Turco Products, Inc. Purpose of the pilot plant is to explore possibilities of chemical etching of steel and titanium required on high-heat-resistant parts.

Representatives of Army, Navy, and Air Force met on June 6 with four committees of the metalworking equipment industry to discuss modernizing programs and equipment problems. Important outcome of the conference: information that new weapons such as intercontinental ballistic missiles will require processing of new and different materials. Impact of such changes on machine tool design is now under study by the Armed Forces.

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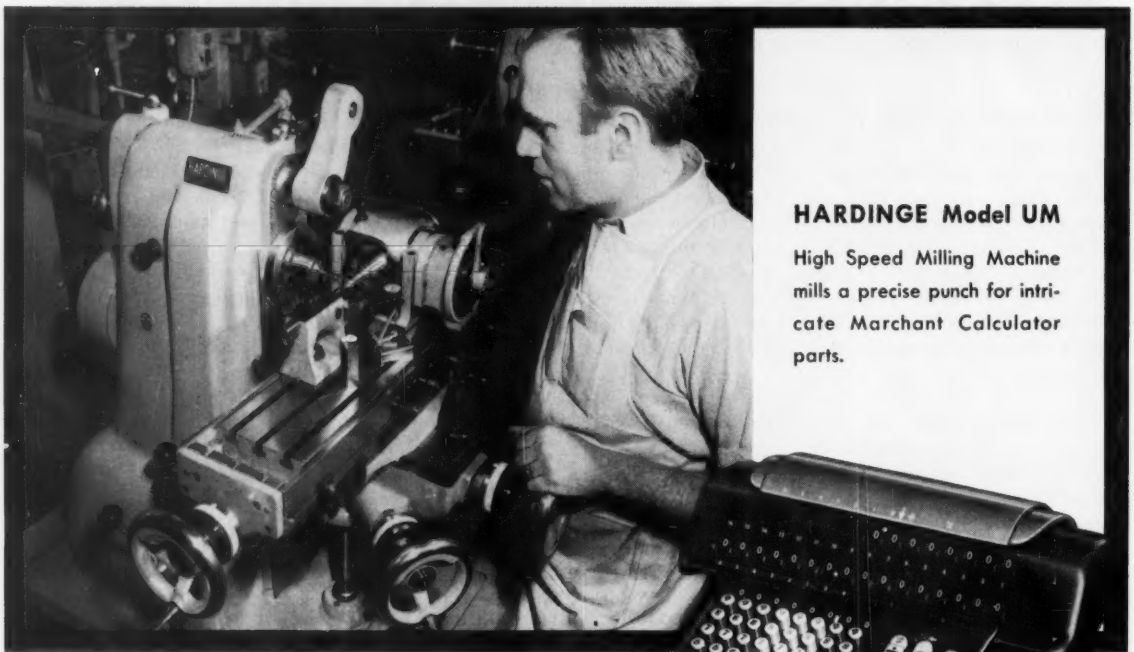

HARDINGE Model UM

High Speed Milling Machine mills a precise punch for intricate Marchant Calculator parts.

High Speed Automatic MARCHANT Figuremaster

PRECISELY MACHINED . . . close tolerance components of Marchant calculators—each functioning with lightning speed—are a tribute to American engineering and make this line of calculators a leader in American business equipment.

HARDINGE High Speed Precision Milling Machines are used by Marchant Calculators, Inc. to produce highly precise tolerance pierce-punches. Milling operations are performed efficiently with speed and accuracies to tenths of thousands of an inch.

For your precision milling requirements, check the HARDINGE Model UM or TM High Speed Precision Milling Machine. Write for descriptive Bulletin.

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MACHINERY
AUGUST 1956

Gears for This Age of Cybernetics

IN the past, when most gears were of relatively coarse pitch and were used solely for the transmittal of rotary motion, the problems of designers and production men were comparatively simple. Generally speaking, all the designer had to do was to specify gears of correct ratios and of adequate strength for the intended application. The production man simply had to make the gears accurate within reasonably close tolerances.

Today, the picture is greatly different. There is a demand for fine-pitch gears of unbelievable accuracy suitable for use in the ultra-precise control equipment of rockets, missiles, radar, and various other new developments in the field of aviation. Such gears must not only transmit force but must accurately measure angular position. They must also operate without backlash at high temperatures with no lubrication and under conditions of high vibration and shock loads. Some of these requirements must also be met by gears used in digital and analogue computing machines. They are the "brains" of mechanical-electrical control devices.

Gears in these categories are being regularly made to the Class 3 precision tolerance of the American Gear Manufacturers Association which calls for a total composite error of not more than 0.00025 inch and a total tooth-to-tooth composite error of only 0.0002 inch. Some engineers believe that demands for instruments in the fields of aviation and nuclear energy will someday necessitate that gears must meet a tolerance which would restrict the total composite error to about 0.00003 inch. Sounds fantastic!

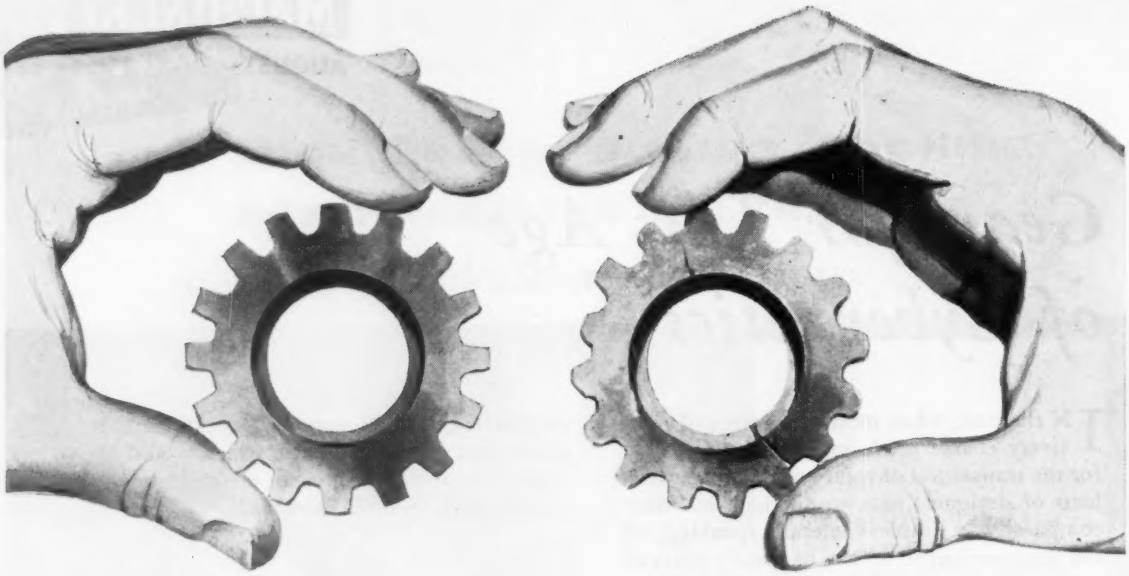
Yet, July MACHINERY carried an article that described the measurement of gear segments on which the tooth spacing must be true within 5 seconds of arc, the teeth having a circular pitch of only 0.050 inch—teeth with an addendum of only 0.0159 inch. How accurate the tooth spacing must be can be visualized when it is remembered that one second of arc amounts to a rise of only about 1/4 inch in a length of one mile. Even though the pitch diameter of the gear segments is over 6 inches, the permissible error in tooth spacing is less than 0.0001 inch.

This number of MACHINERY features an article that describes the manufacture of fine-pitch gears of various types to meet stringent instrumentation requirements. Another article dealing with the application of autocollimators to determine minute errors in fine-pitch gears has been scheduled for early publication.

Truly, the production of gears for our age of cybernetics, in which control systems are tending more and more to simulate the human brain and nervous system, has necessitated a manufacturing skill that would have been inconceivable to gearmakers of bygone days.

Charles O. Herb

EDITOR



"What's wrong? They're both 8620 alloy steel!"

A Baltimore manufacturer was working on an order for oil pump gears of 8620 alloy steel. The first lot of steel attained satisfactory core hardness—but the second lot would not meet minimum hardness requirements.

Both lots were bought from a reputable source. What went wrong?

The same alloy, sure—but different heats!

The manufacturer ran into trouble because the chemical composition and hardenability of different furnace heats of the same alloy can and do vary (within AISI and SAE limits) enough to have a marked effect on heat treatment response. As a result of such variation, the "right" alloy failed.

Here's why this can't happen with Ryerson alloys

Unfailing protection against the hazards of varying properties and hardenability is always yours when you specify and buy Ryerson certified alloys. That's because we test *your particular lot of steel* for heat treatment response, verify its chemical composition—and give you a record of these tests, keyed to the identification symbol on the steel.

So there's no guesswork—no need to rely on *typical* hardenability figures for your type of steel. With Ryerson certified alloys you know the *actual*, proved hardenability of the steel.

This extra assurance of quality doesn't cost you a cent—and it's only part of an 8-step quality control program to prevent the breakdown of equipment, the scrapping or reworking of rejects that may result when you're not sure of the alloys you buy. So next time—order Ryerson certified alloys and be sure.

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In stock: Bars, structurals, plates, sheets, tubing, alloy and stainless steel, reinforcing bars, machinery & tools, etc.

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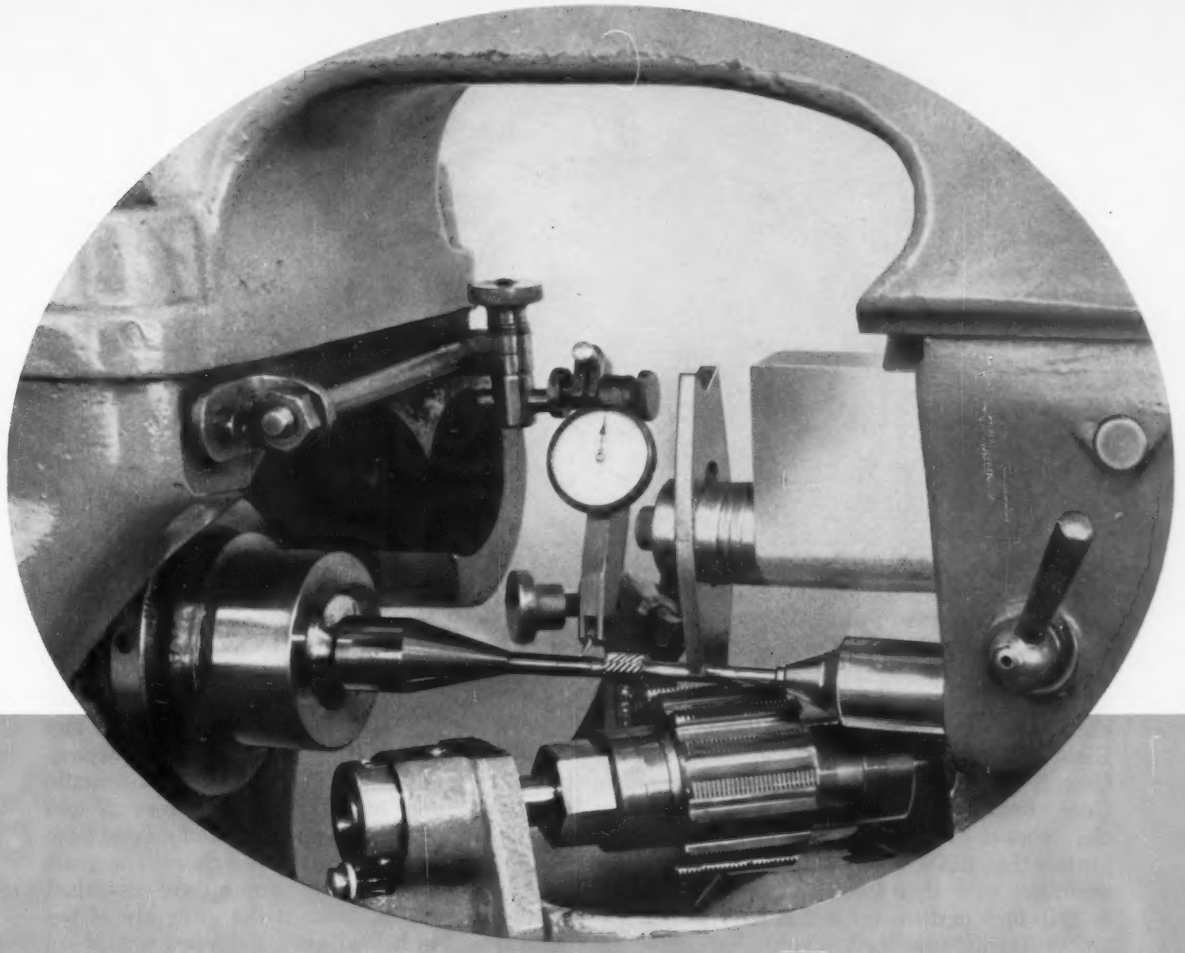


Gears with Only 0.0005-Inch Total Composite Error

An almost unbelievable requirement of airborne radar control gears is a backlash of only 0.0000 to 0.0005 inch in a gear train

By CHARLES O. HERB, Editor

ELECTRONIC systems for controlling the flight of every type of American and Canadian interceptor aircraft are produced by the Hughes Aircraft Co. These systems make it possible for interceptors to meet attacking bombers many miles away from centers of population, night or day, in any kind of weather. Although the interceptor pilot may never "see" the enemy planes, the system enables him to destroy them and return safely to his base. Certain types of these electronic systems can automatically launch

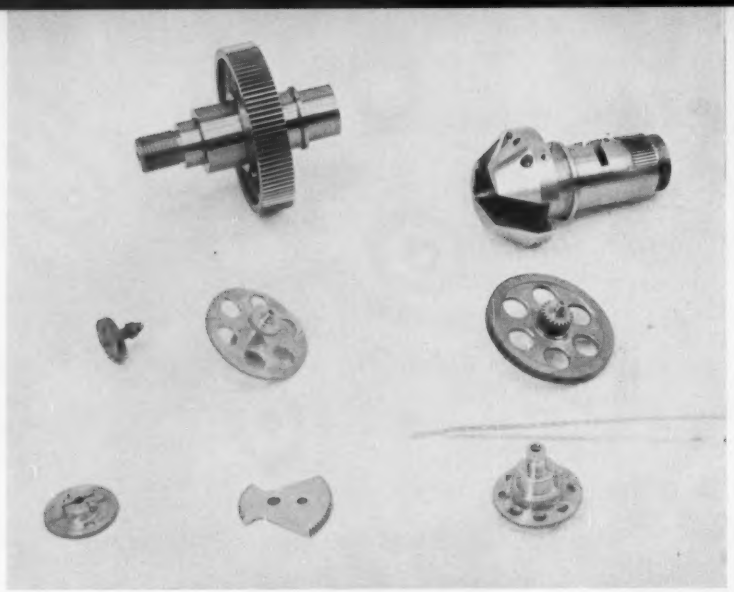


Fig. 1. Examples of gears produced for use in airborne radar control instruments by the Hughes Aircraft Co.

Hughes Falcon air-to-air guided missiles which can steer themselves to the kill.

Fine-pitch gears for these electronic systems are built to extreme accuracies in the Culver City, Calif., plant of the company in quantities that have reached as high as 15,000 monthly. Eighty per cent of the production must meet the Class 2 precision requirements of the American Gear Manufacturers Association. In most cases, the tooth-to-tooth composite error cannot be greater than 0.0003 inch, and the total composite error, not more than 0.0005 inch. Gears as small as 3/16 inch in diameter and as large as 4 inches are ordinarily produced. Typical examples are shown in Figs. 1 and 2. The diametral pitch of the gears ranges from 120 to 32.

Trains of four or five gears must not have a backlash of more than 0.0005 inch in some instances, and not more than 0.0015 inch in most cases. Many gear trains are selectively assembled to have a backlash of only 0.0002 inch between meshes. The gears must carry a comparatively heavy load and are, therefore, precisely hardened. Center-to-center distances of gears in their housings are also held within a tolerance range of 0.0005 to 0.0010 inch.

All ball bearings used in gear trains are checked with a microscope to make certain that surface finishes and general workmanship meet requirements. Outside diameters and bores of ball bearings must be coded within 0.0001 inch. The bearings are checked for size on air gages having a 10,000 to 1 amplification. Radial and axial play are also checked by means of air gages. Bearings that must meet critical torque and friction requirements undergo a severe inspection. All ball bearings are grease-plated by an ultrasonic process to reduce friction to a minimum.

One of the most important considerations in manufacturing fine-pitch gears to close tolerances is to use good blanks. Consequently, before any blanks reach the Hughes gear cutting department, they are rough-machined on an automatic screw machine, heat-treated to between 27 and 32 Rockwell C, finish-machined, and ground both on the flat faces and on the periphery. The gears are heat-treated in an atmosphere-controlled Lindberg furnace. Most of the gears are of the spur type, but helical gears and a few worms are also manufactured. The drawing in Fig. 3 shows the close tolerances and other important specifications given for a typical gear and pinion that are integral on one shaft.

Spur gears are generally cut on standard Fellows fine-pitch gear shapers, as seen in Fig. 4.

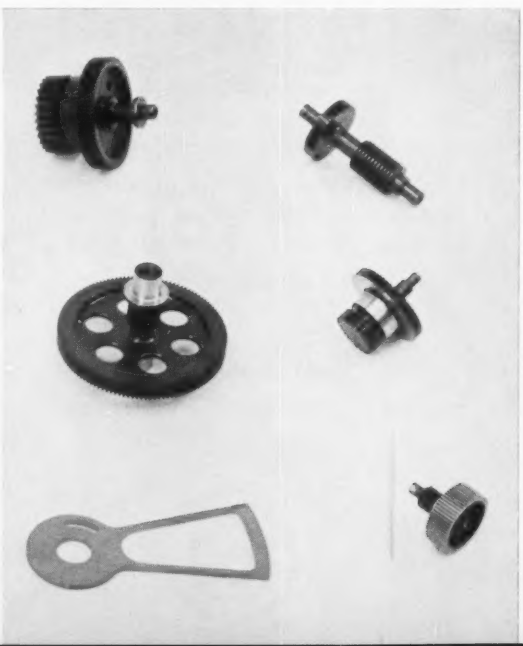


Fig. 2. The radar control gears are made in sizes from 3/16 inch to 4 inches with a diametral pitch from 120 to 32.

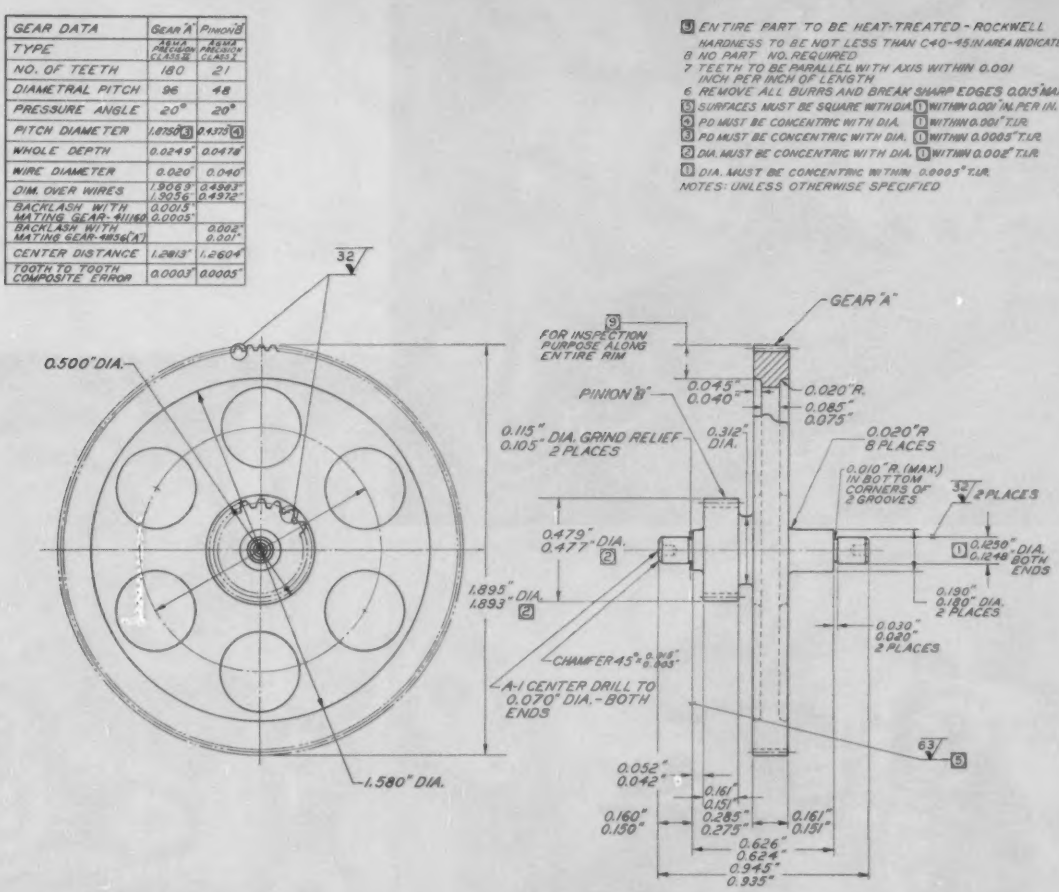


Fig. 3. Drawing of a gear and pinion made integral with a shaft illustrating the close tolerance specified on a typical fine-pitch gear.

Helical gears are produced on the Hamilton hobbing machine seen in the heading illustration and in Fig. 5, although this equipment is also suitable for cutting spur gears. Most gears have from 0.0002 to 0.0003 inch of stock shaved from the profile of the gear teeth. Shaving operations are performed on a Fellows No. 4 gear shaver, shown in Fig. 6. After shaving, the gears are hardened with the Tocco induction equipment illustrated in Fig. 7. Most gears are hardened to between 50 to 55 Rockwell C, although some gears are hardened to 60 Rockwell C.

The teeth of many gears are ground from the solid after heat-treatment to eliminate any distortion and, thus, obtain the greatest possible accuracy of hardened gears. Grinding of teeth is performed on the Sheffield Model 140 reciprocating gear grinding machine seen in Fig. 8. From the close-up views in Figs. 9 and 10, it will be observed that a multiple-rib grinding wheel is used. These ribs comprise a basic rack of the desired pitch which is formed helically on the face of the wheel. Gears of 16 diametral pitch or finer can be ground on this machine from a solid blank—several gears at the same time.

The grinding operation is similar to hobbing; the work revolves continuously at a rate of speed that is synchronized with the speed of the grinding wheel. Simultaneously, the work moves upward past the horizontal level of the wheel until the tooth form is imparted to the full face of the gear blank. In addition to this basic hobbing motion, the work rolls across the full face of the helical rack form of the grinding wheel.

From the time that the gears are shaved or ground, extreme accuracy is observed in handling them between important operations and the assembling department. Each gear is placed in a separate polyethylene bag to avoid damaging it.

All gears undergo rigid inspection that involves operations on several machines. There is, for example, a Parkson machine in which gears are rolled in mesh with a master to determine the exact center distances of mating gears. Then, the gears are checked on the Fellows No. 4 fine-pitch Red Liner illustrated in Fig. 11. Variations in

Fig. 4. Fine-pitch spur gears are principally produced on Fellows gear shapers of the type here shown.

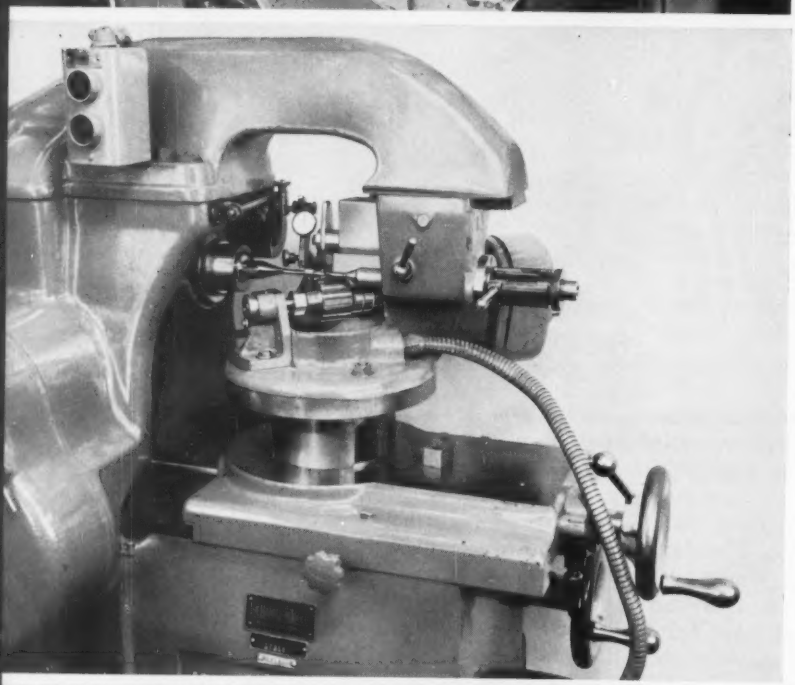


Fig. 5. A helical gear is shown being cut on this hobbing machine. From 0.0002 to 0.0003 inch is usually shaved from the gear teeth in a subsequent operation.

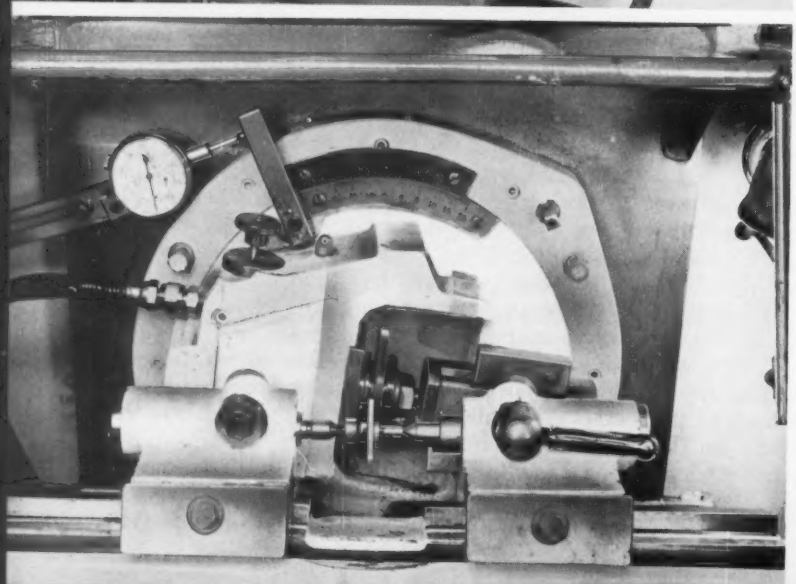


Fig. 6. Teeth of all gears are shaved in standard machine setups, such as the one here illustrated.

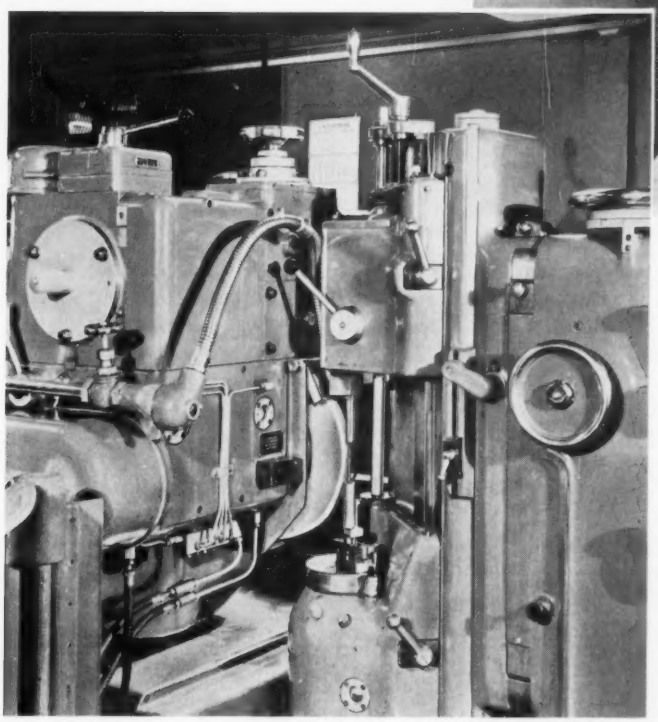


Fig. 7. (Above) Gears are ordinarily hardened with Tocco induction equipment to between 50 and 55 Rockwell C.

Fig. 8. (Left) Many gears have their teeth ground on this Sheffield reciprocating gear grinding machine.

Fig. 9. (Right) Close-up view of machine in Fig. 8 showing a typical gear blank and the helical ribbed wheel which can produce gear teeth complete from a solid blank.

Fig. 10. (Extreme right) Teeth had been ground completely from the solid blank shown in Fig. 9 at the time this photograph was taken.

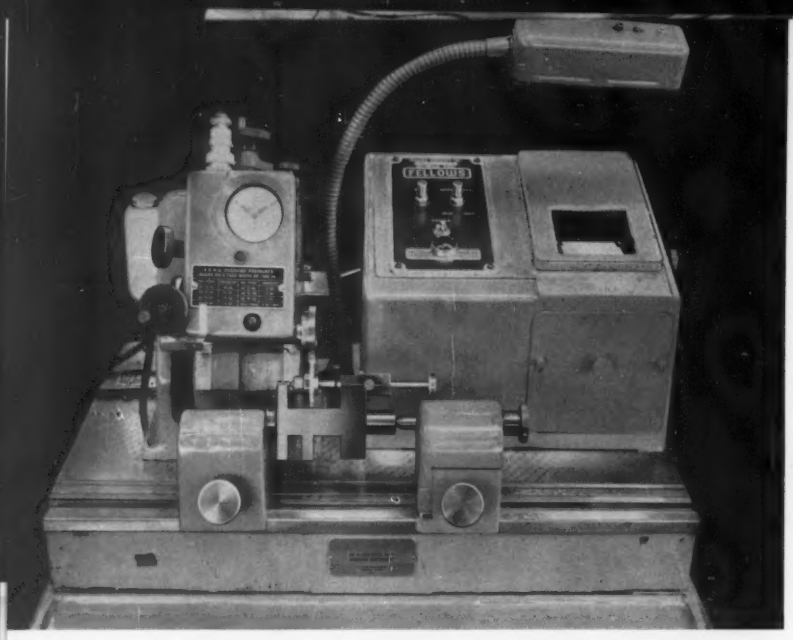
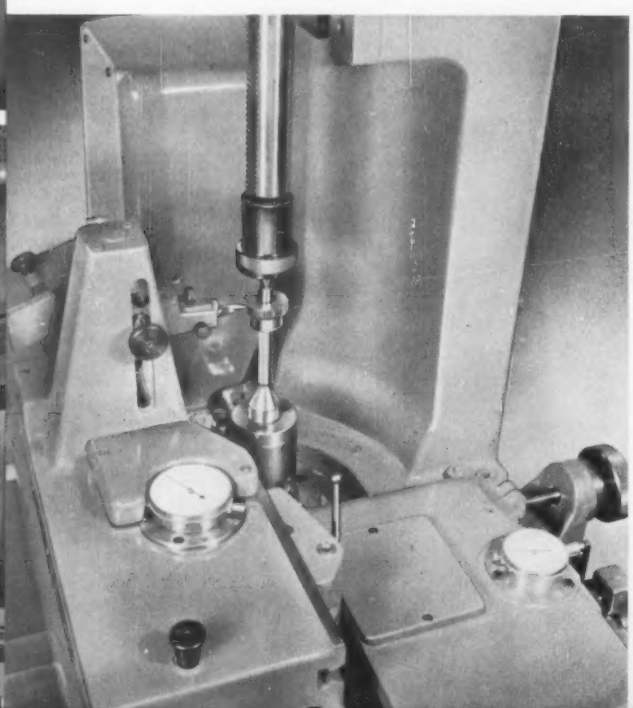


Fig. 11. Gears are checked for tooth-to-tooth and total composite error on a fine-pitch Red Liner.

center distance between the master gear and the work are measured and recorded on a constantly moving paper chart as the two gears rotate in intimate contact. This type of measuring is designated by the American Gear Manufacturers Association as a "composite check." The chart records all errors in combination, and each type of error produces a characteristic deviation from a straight line so that the inspector can readily determine the extent and type of error.

The master gear is mounted on an arbor that is held in a movable spring-loaded carrier and the master is meshed with the work without any backlash. The master gear can be rotated either by means of a handwheel or through a motor drive. Errors in the work will cause a change in center distance. This change is registered on a dial indicator as well as on the paper chart. The movement of the master gear carrier operates an electrical sensing device, the output signal of which is amplified to actuate an electrical recorder. The amplification can be 200 to 1, 400 to 1, or 800 to 1. When using the 800 to 1 amplification, the space between two of the fine vertical lines on the paper chart represents a center distance change of 0.00005 inch.

Fig. 12. Involute measuring instrument recently installed for determining the amount and exact location of any involute error in a gear.



The speed of the motor-driven master gear can be varied for different pitches so that the tooth velocity may be maintained at the best operating condition. The paper chart roll is also driven by the motor, since there are two rates of paper travel, 5 and 10 inches per revolution of the master gear. The pressure between the master gear and the work is adjustable to conform with AGMA standards for measuring fine-pitch gears. This is adjusted by means of a knob, the pressure being indicated on a graduated plate.

A Fellows No. 12M involute measuring machine shown in Fig. 12 was recently installed to provide a means of quickly and accurately checking the involute profiles of gears. This machine is applicable to both external and internal spur and helical gears. The principle employed makes use of a master involute cam that is developed from a large base circle which covers the maximum capacity of the equipment. A pointer which contacts the tooth of the gear being measured is set at the desired base radius by positioning the main slide (extending from left to right in the foreground in the illustration) through the use of gage-blocks, a micrometer, and a dial gage. The indicator slide, which extends along the front of

Fig. 13. All bearings used in gear units are checked for visual defects by means of a nine-power microscope.

the machine, carries a dial indicator and the measuring pointer. This slide is set in the so-called "starting" position by means of a stop and a spring-actuated plunger.

Provision is made for checking the location of tooth modifications by a graduated dial that rotates in unison with the work and indicates in degrees the "angular" length of the involute from the base circle. This dial, in combination with the dial indicator on the indicator slide, enables inspector to accurately determine errors in tooth profile and the angular location of such errors or modifications.

In addition, the equipment is provided with an electrical recorder which permanently records errors on a ruled paper chart. The involute is recorded with reference to straight lines and any departure of the charted line from the straight lines represents the amount of error. The angular location of the error or modification is indicated by the position of the charted line relative to the accurately spaced curved lines. The space between the vertical ruled lines represents an error of 0.0002 inch. The instrument is provided with a ratio device so that the spaces between the curved lines can represent either 3 degrees or 1/2 degree of involute.

Accurate gears are insured in this shop through close cooperation between the engineering and production departments. Without strict control, the extreme accuracy would be unobtainable.

Mention has already been made of the special attention given to all ball bearings used in gearbox assemblies. Before application, ball bearings are ultrasonically cleaned in an operation in which radio waves are employed at a frequency of 18,000 cycles per second. The laboratory technicians in Fig. 13 inspect ball bearings for visual defects under a nine-power microscope. Two other technicians are seen in Fig. 14 taking torque readings as previously explained. This inspection is performed with a Fafnir torque checker.

Fig. 14. Ball bearings having critical torque and friction requirements are given a suitable inspection with the equipment here illustrated.

Induction Heating Streamlines Production-Brazing Practices

By C. W. HOLT
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THE acceptance of induction heating for soldering and brazing applications has led to many economies in fabricating parts for automobiles, farm implements, business machines, domestic appliances, and machine tools. Its versatility is such that it is equally at home either in the toolroom or in the most up-to-date production line.

In the toolroom, for example, controlled local heating permits the brazing of carbide or high-speed steel tool bits to the shanks of relatively large lathe, shaper, or planer tools, without the necessity of heating the entire tool. Also, the brazed joint is free of local stresses upon cooling. Many salvage operations can be performed such as brazing together the pieces of broken drills, reamers, milling cutters, and repairing damaged tools of other types.

Suitable locating devices for small-quantity operation may be constructed from asbestos boards which will support the work during heating and brazing yet will not interfere with the functioning of the induction coil. Barrel jacket components are shown being brazed on a 20-K.W. induction heater in Fig. 1. The supporting fixture for the jackets is built from asbestos boards.

By far, however, the greatest use of induction heating for soldering or brazing is in repetitive operations performed in the production of both small and large sub-assemblies to be employed in many of today's tools, implements, and appliances. The use of simple fixtures permits operators to produce consistently good work with very little skill.

Induction heating is generally limited to low-

and medium-temperature (soft soldering and silver brazing) applications. Difficulties encountered in surrounding the work with a suitable protective atmosphere to prevent oxidation discourage its use for high-temperature applications involving brass, bronze, or copper brazing. Although gas atmospheres have been used to a limited degree, proper sealing of the chamber involves arrangements that are usually both bulky and awkward and that interfere with the effective use of induction heating for this type of operation.

For applications in which brass, bronze, or copper must be used as a bonding material, the electric brazing furnace should be considered. Its ability to maintain an accurate and uniform temperature and to contain a suitable non-oxidizing or reducing atmosphere will produce consistently satisfactory results.

As in electric furnace brazing, induction brazing permits assemblies of inexpensive punchings and stampings to be substituted for intricate castings or machined parts. Induction heating often can be used at a point between these two extremes. In such cases, bosses, ribs, or stamped or punched pieces can be added to either simple castings or machined parts, as shown in Fig. 2, to reduce the over-all cost of finishing. This is particularly true if the pieces to be added are small and light with respect to the size and weight of the casting, since induction heating permits localizing of the heat at the point where the bond is to be made and the adjacent area.

Areas to be Brazed Should Not be Heated Too Rapidly

Induction coils that have been suitably shaped and then positioned adjacent to, or around, the area to be joined induce currents in the work of such magnitude as to cause a build-up of heat in the immediate vicinity. With the availability of sufficient power, the temperature of the work is raised rapidly, permitting the brazing material to flow into the joint without undue heat induction into remaining portions of the pieces. Control of the temperature is obtained by first determining the time required to bring the work to brazing heat and then setting an automatic timer to provide repetitive cycling of the operation.

Although it is desirable to perform brazing operations as rapidly as possible, in an effort to reduce production costs, care must be taken not to heat the work so rapidly that cold, cast joints are obtained. As a guide, a minimum of fifteen seconds should be allowed to heat the work and to flow the bonding material throughout the joint. In many cases, the power available and the size of the parts to be joined are such that heating can be accomplished in a much shorter time. However, due to the possibility of producing cold, porous, or weak joints, the accepted practice is to heat several assemblies at once, thereby putting less power into each induction coil. In this way, the unit time remains short even though the over-all time to heat the several assemblies is correspondingly longer.

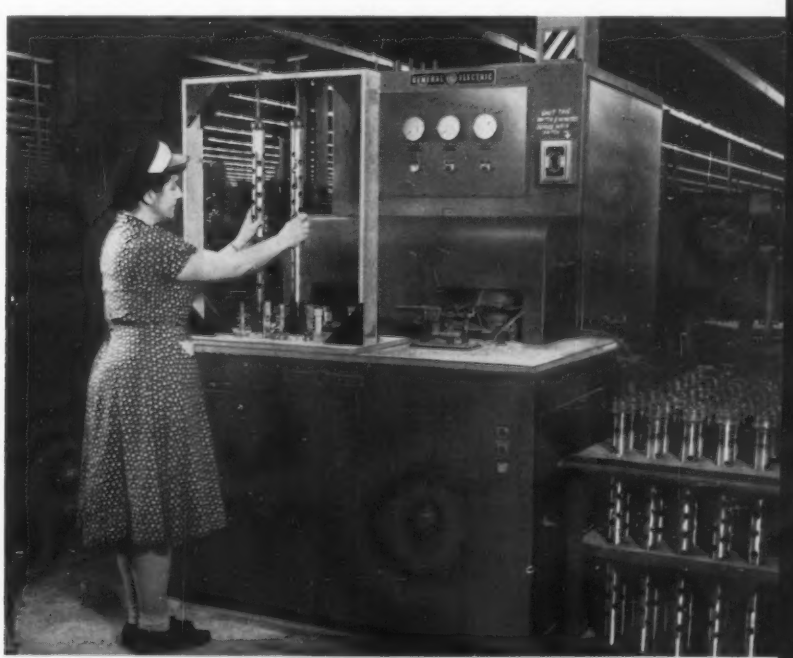

Fig. 1. Brazing barrel jacket components for ordnance work on a 20-K.W. induction heating unit. Asbestos boards are employed for constructing the work-fixture.

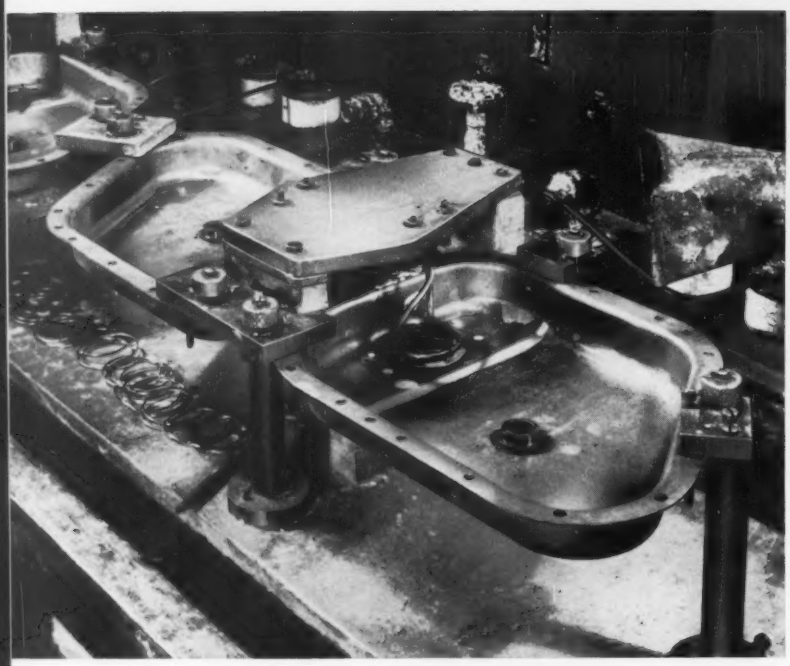

Fig. 2. Bosses that have been machined from bars are being brazed to sheet-metal cover stampings. These assemblies are replacing comparatively expensive castings.

As a result, each assembly heats slowly so that the temperature of the mating parts is more uniform, the flux melts and flows over the heated areas properly to protect them from oxidation, and the brazing material melts fully and flows throughout the joint for the strongest bond. The brazing of small overload-relay heater assemblies, Fig. 3, which can be brought to an elevated temperature rapidly if handled individually, can best be done in multiples to benefit from the longer time required for heat build-up when processed in this way.

Joint Strength is Dependent on Proper Clearances

When soldering or brazing by induction, proper clearances between mating members are just as important for producing good joints as they are when other heating methods are used. In silver brazing, joint clearances ranging from 0.0015 to 0.003 inch are desirable. Smaller clearances tend to prevent a complete wetting action throughout the joint. In spite of this, there have been several cases in which greater strength has been obtained when light press fits were used.

Clearances that are larger than those suggested tend to break the capillary force and permit the bonding material to either flush out of the joint or "ball-up" to produce a cast joint. Excessive clearances also materially affect the cost of soldering or brazing since more alloy will be used in an effort to fill the void and provide what appears to be an acceptable joint. It follows, that proper clearances should be maintained in production work to assure strong joints at minimum cost.

Type and Application of Flux Affect Joint Quality

Many types of flux are commercially available to meet the wide variety of conditions encountered in industry today. Neutral fluxes such as resin or resin-in-alcohol are non-corrosive. They are used with the lower melting point, or soft, solders. This type of flux is used where corrosive action must be avoided and/or where washing is not feasible. On the other hand, its cleaning action is slight, making it unsuitable for oxidized surfaces.

Although fluxes such as zinc chloride or ammonium chloride—or mixtures of both dissolved in water or mixed with petroleum paste—are more active, they are also corrosive. Joints must be washed completely with hot water after soldering.

The paste type flux for silver brazing is generally used in the induction method since it adheres to the work well and does not have to be applied during heating. The purpose of the flux is to prevent oxidation during heating, absorb any residual oxide on the surface of the work, and aid the flow of alloy by presenting a clean surface to the molten material.

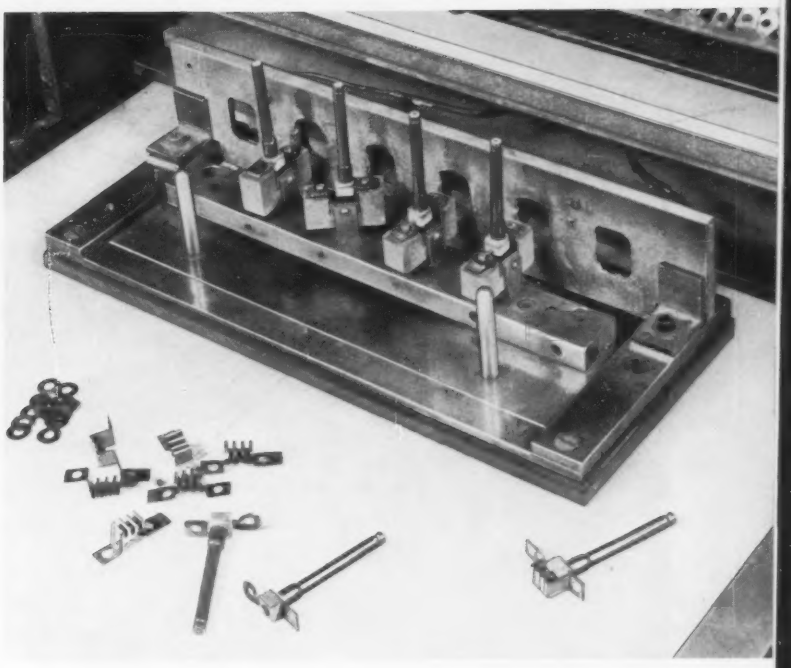

Fig. 3. Fixture for positioning the parts of an overload-relay heater. By brazing in multiples, the delicate parts of assembly will not be heated too rapidly.

Fluxes can be applied by dipping, brushing, or spraying before heating the parts, and either before or after the individual pieces are positioned in a fixture. Applying silver brazing flux at a temperature of 120 to 140 degrees F. to the joint seems to assist the wetting action and offer greater protection from oxidation, particularly when the heating cycles are relatively long.

Better protection from oxidation is obtained if the flux is allowed to dry on the work before brazing. Since the base metal is heated rapidly, violent boiling of the liquid in a wet flux occurs which tends to flake off the flux and expose the metal to the air. If the flux is dry, there is no water to evaporate and it remains in place to protect the metal. In addition, when the brazing alloy is preplaced around the joint, as can be seen on the end plug of a printing-press roll at the left in Fig. 4, the dry flux tends to hold the alloy in position. The risk of alloy displacement due to boiling of wet flux is avoided.

Liberal use of any flux is no substitute for

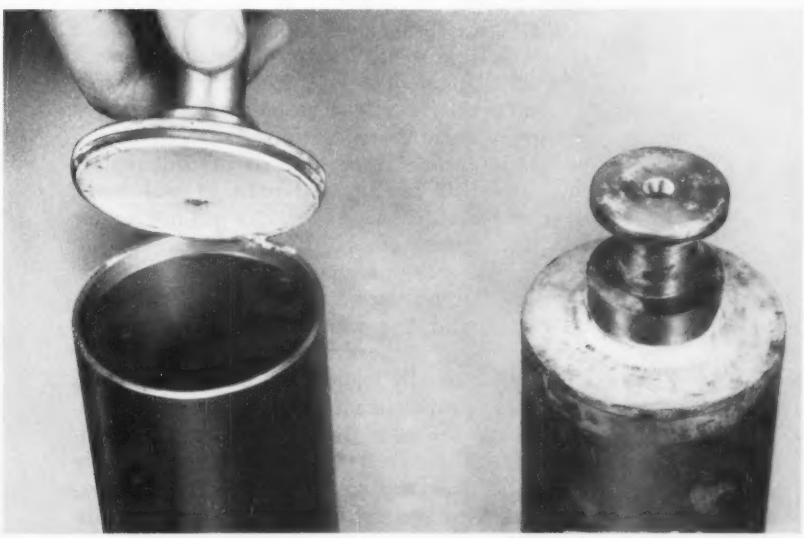

Fig. 4. A ring of brazing alloy is held in position on the end plug of a printing-press roll (left) by a coating of dried flux. The assembly is also shown after brazing (right).

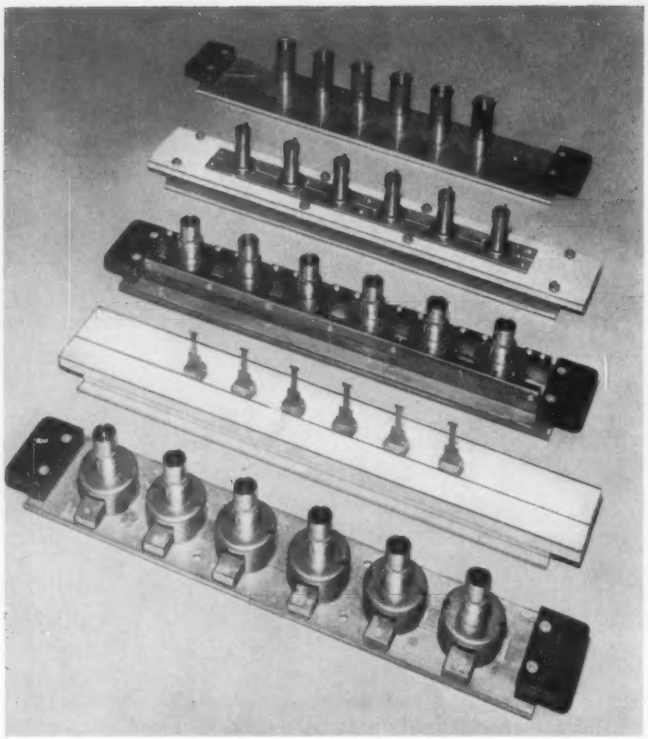

Fig. 5. Loading trays containing various door-lock assemblies that are to be induction brazed. These trays are subsequently positioned on the platen of a brazing fixture.

clean metal. The choice of a suitable method of cleaning—whether chemical, abrasive, or both—will depend on the condition of the work and the quantities involved. After cleaning, care should be used to avoid handling the joint areas to prevent a redeposit of body oils on the surfaces. Satisfactory joints cannot be obtained if the affected areas are unclean, scaled, or oxidized. Following brazing, the flux can be removed easily by a hot-water wash.

Considerations in the Design of Applicable Fixtures

The parts to be joined should be arranged so that the brazing alloy can be preplaced in, or adjacent to, the joint prior to heating. Therefore, when the work has been brought to the proper temperature, the correct amount of alloy will be in its proper location and will flow into the joint.

In some instances, the assemblies to be joined will be self-supporting and will remain so during the brazing operation. In these cases, the operator need only rest them on an asbestos block in proper relation to the coil. In general, however, a fixture must be used to support and position the parts of the assembly with respect to each other and to the induction coil. The fixture must be designed for easy insertion and secure holding of the work. Also, the fixture usually supports the induction coil or coils so that they are in register with the work-pieces.

Care must be used in the design and construction of any fixture to allow as much clearance as possible between the coil and metallic structural members of the fixture. Should the coil be placed too close to these members, they will also become heated with resultant loss of the useful power available from the heating equipment. It may be desirable to build this portion of the fixture from asbestos boards.

In other cases, steel fixture or machine members can be adequately shielded by placing a thin copper sheet over or around the areas where heating occurs. When fixture or machine members cannot be repositioned or adequately shielded with copper, provision to water-cool them can be made. However, this will not reduce the power being absorbed by the members but merely reduce their temperature.

Depending on the nature of the assemblies to be joined and the production rates involved, work-handling devices will be either simple or complex. Manually loaded and unloaded fixtures frequently provide a satisfactory rate of production and, at the same time, are comparatively inexpensive. There are but few cases in which fully automatic machines are used in induction brazing operations because of the expensive, coordin-

ated type of feeding unit required to pre-assemble and flux the parts, pre-position the brazing alloy, and then place the assembly in heating position.

In the brazing of door-locking parts, as shown in the heading illustration, a pair of smaller fixtures provided with interchangeable induction coils and work supports become multiple-purpose tools for brazing a variety of assemblies with a minimum of change-over time. Solder rings are pre-positioned over the joints, flux is applied, and the parts are positioned on a loading tray such as those shown in Fig. 5. The tray is then slid into the fixture and the parts are elevated into the stationary coils. A timer at a push-button station controls the cycle length. At the end of the heating cycle, the brazing alloy is allowed to set, and then the work is lowered from the coils. The tray and assemblies are removed from the fixture and washed in hot water to remove the flux.

Induction heating often can be used to advantage in soldering thin, tempered diaphragms to the bodies of pressure regulators or to bellows. It permits rapid, localized heating of the work, causing the solder to flow quickly and complete the bond before heat is conducted into the diaphragm to draw its temper. Immediately after the joint has been made, the completed assembly is quenched with water, as illustrated in Fig. 6, to remove objectionable heat.

Advantages of induction heating are also evident in the joining of parts that have been heat-treated previously. Pinions, hubs, and collars are often silver brazed to hardened shafts with only a short length of the shaft adjacent to the joint being affected adversely. The surfaces of the hardened shafts to be brazed usually have been ground to produce a good finish. To protect this finish from oxidation during the brazing operation, it is customary to apply flux to all areas of the pieces that are subjected to elevated temperatures. More flux is used, but satisfactory protection is generally obtained.

While no attempt has been made to either evaluate or recommend ratings of induction heaters that should be used in any soldering or brazing operation, some factors affecting their selection are:

1. Physical size of the parts to be brazed.
2. Area of the joint to be heated.
3. Material from which the parts are made.
4. Soldering or brazing alloy to be used.
5. Temperatures to which the joint must be raised.
6. Production rate desired.
7. Ability to couple power into the work.

Induction heaters have been considered here as production tools for soldering or brazing. They can be used just as readily and effectively for other heating applications. These range from heating for shrink-fitting purposes to surface hardening or annealing areas of assemblies that previously have been brazed with the very same heating equipment.

Fig. 6. After thin, tempered diaphragms have been induction brazed to the bodies of pressure regulators, the joints are quickly water-quenched in order to remove objectionable heat.

Dimpling Stainless-Steel Foil

Rejects from cracks and wrinkles vanish and heat-radiation factor is doubled

By J. E. Hagins
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Douglas Aircraft Co., Inc., El Segundo (Calif.) Division

STAINLESS-STEEL foil shows a marked increase in formability, as well as a doubling of its heat-radiation factor, when given a preliminary dimpling. The method, a type of embossing, was developed at Douglas Aircraft's El Segundo Division, and is applied to 0.002- and 0.004-inch thick foil used to cover both surfaces of soft absorbent blankets which encase high-temperature heat ducts in jet engines. Whole areas surrounding the engines are fire-shielded with these insulating blankets.

Foil sections and blankets are shown before and after assembly in Fig. 1. The two sheets of foil that enclose the fiber material are secured together by spot- or seam-welding the edges, spot-welding being employed for the small blankets and seam-welding for blankets wider than 24 inches—the standard width of the foil.

Any foil that is only half the thickness of a human hair is extremely fragile. The handling of large flat sheets of the material produced slight bends or stretch risers that developed into cracks. When the foil was contoured to fit around parts, it always wrinkled and sometimes cracked. The amount of metal in the cross-section of the flat sheets was insufficient for the amount of flow that necessarily occurs in bending. Cracked foil parts were automatically rejected, and it was found that wrinkled parts would split in service when vibration was transmitted to the foil.

In attempting to solve the problem, it was decided that sufficient material for forming could be obtained by embossing a multitude of dimples over each sheet in a unidirectional, staggered pattern. Dimples furnish enough metal for stretching at critical radii, and the staggering eliminates the formation of stress lines.

The embossing die is made of standard aluminum grid stock, 0.025 inch thick. Holes to produce the dimples are countersunk by hand to a diameter of 5/32 inch at the top. Spacing is such as to create an interlocking honeycomb. Then the grid, with the dimpling holes down, is bonded to a 1/2-inch thick aluminum plate of matching length and width. Bonding is effected by means of double-faced adhesive tape.

Placed in a Verson-Wheelon press, the die receives the foil and embosses it at a pressure of 3000 pounds per square inch. This equipment employs an inflatable rubber bag. (See "Sheet-Metal Forming without Vertical Press Movements," Machinery, June, 1952.) Hydraulic pres-

Fig. 1. Formed sheets of dimpled stainless steel enclose the insulating blankets. Edges of sheets are resistance-welded.

sure causes the foil to flow gradually into the grid holes without straining the metal.

To emboss parts wider than the standard 24-inch stainless-steel foil sheets, two pieces of foil are seam-welded together to make blanks up to the 36-inch width of the die. One-quarter hard 18-8 stainless-steel foil 0.004 inch thick can be dimpled effectively this way.

After the foil has been embossed, it is formed either in a "trapped rubber" press, as in Fig. 2, or under a drop-hammer. Drop-hammer dies made of Kirksite have rubber faceplates. For greater strength, stiffening beads can be added.

Formed parts are next assembled around the insulating blankets and spot- or seam-welded as already mentioned. An assembly which lends itself to spot-welding because of the ease with which the operator can manipulate the part is shown in Fig. 3. The seam-welding process illustrated in Fig. 4 is employed because of the unwieldy construction of the parts to be joined. Here, roller electrodes provide a constant guide for the foil edges and leave the operator free to control the movement of the assembly.

Embossing has cut shroud failures to a minimum, and the life guarantee of parts supplied to

Fig. 2. The unidirectional pattern of the dimples can be seen in the sheet after it has been formed. Sheets to left of die have already been embossed.

the customer is surpassed consistently. Because of its flexibility, the embossed sheet can be used to insulate a large variety of airplane components. Typical insulating blankets that have been successfully employed are shown in the heading illustration.

An unsought extra advantage has been derived from the use of the embossed sheets: The dimples have increased the heat radiation of the foil at least 100 per cent above that of the foil when flat, thus giving a more efficient product.

Plastic Tooling Research Project

A research program on properties of plastics used for tooling applications has been initiated by the American Society of Tool Engineers Research Fund. A $10,000 contract has been awarded to the Purdue Research Foundation. In conjunction with the ASTE Research Fund, co-sponsors of the project include: Bakelite Co., Division of Union Carbide and Carbon Corporation; Shell Chemical Corporation; Ciba Co., Inc.; and Marbelette Corporation.

Fig. 3. (Right) A heat duct covered with dimpled foil being assembled by spot-welding. Because the part is small, it can be conveniently manipulated.

Fig. 4. (Left) Roll seam-welding a foil blanket for a jet engine. Cumbersome lengths are easily handled by this method.

Paired Boring Machines Turn Out Transmission Casting

Multiple tooling on duplicate machines—one of which is loaded while the other is operating—expedites production of transmission stators at Buick

By Herbert Chase

OUTER stator assemblies for the Buick Dynaflow automatic transmission contain a circular aluminum die-casting on which a series of light machining operations is performed. Static balancing within 0.250 ounce-inch is required for the finished stator assemblies.

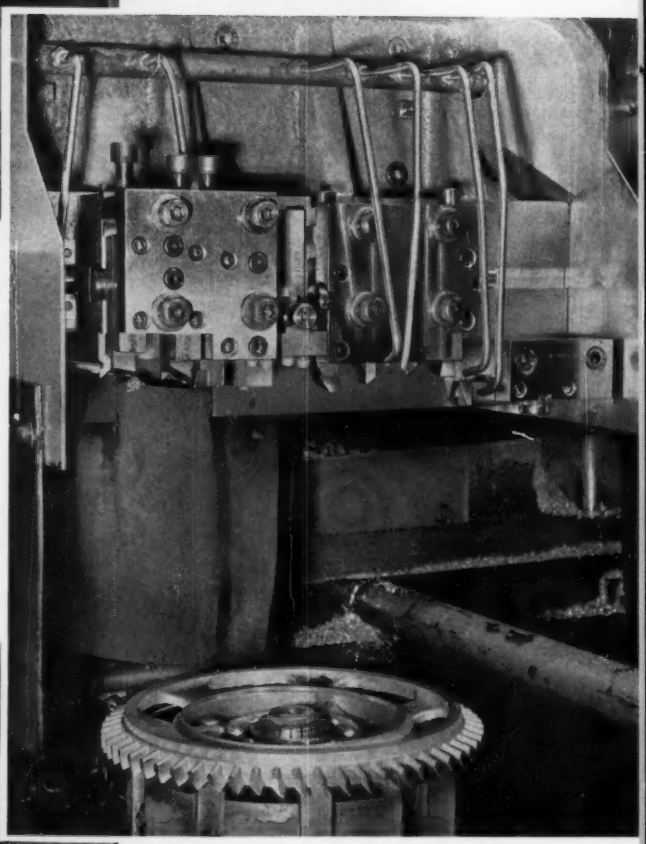
Most of the work on this casting is done by duplicate tooling on four Heald two-spindle, vertical Bore-matics which are used in pairs. Castings are processed two at a time on one machine while an idle machine is loaded. Before coming to the Bore-matics, irregularities on the top face are filed off on a vertical speed lathe. This assures proper location in the fixtures of the Bore-matics.

In the first boring machine operation, illustrated in Fig. 1, the casting is loaded in a fixture and secured by three finger-clamps. A guard is lowered to enclose the work, and a spindle, equipped with six carbide tools, is then fed down to rough-bore the hole. Then, a steel bushing is inserted in the hole, and both faces of a central rim in the casting are rough-machined during a cross-feed of the head. The same procedure is followed at the second spindle of the machine.

On the second pair of Bore-matics, the same surfaces are finish-machined, using tooling sets that are duplicates of those provided on the first pair. In addition, a light chamfering operation is performed. The castings then go to a Buhr machine, where an eight-hole rivet circle is drilled concentrically with the bored center of the workpiece. These holes are chamfered by tools on a second multiple-spindle head on the opposite side.

After inspection, each casting goes to a Hannifin press, where rivets are inserted into the holes after a steel hub has been assembled into the machined central recess. The rivets are headed

Fig. 1. (Left) Close-up view of a Bore-matic machine that rough-bores center hole of stator castings.



two at a time by applying approximately 600 pounds of pressure.

The castings are next transferred to a third pair of Bore-matics, Fig. 2, where each assembly, located from the bore and face of the steel insert, is rough-machined on the side that was positioned downward in the previous operations. Machining here includes turning the outside periphery of the vanes, rough-boring a recess to a diameter of approximately 6 1/2 inches, rough-facing four surfaces, and rough-turning a shoul-

Fig. 2. (Above) This machine is tooled to perform seven boring and turning operations.

Fig. 3. (Left) Walnut shell granules used in this blasting machine remove burrs from the stator assemblies.

der to approximately 9 1/2 inches. While these cuts are being made with eleven carbide tools in the automatic cycle on one of the machines, the operator loads the second machine of the pair. As in previous operations, the machines are run alternately.

On the final pair of boring machines, finishing cuts are taken where needed on surfaces rough-machined by the preceding pair. The dimensions of four diameters must be held concentric to the bore within 0.002 inch (total indicator reading). Four surfaces must also be parallel with the face of the steel hub within 0.004 inch. The close dimensions are checked by use of gaging fixtures such as shown in the heading illustration.

As every stator assembly must be free of burrs, the castings are passed through a Wheelabrator blasting machine, Fig. 3, which has a horizontal, rubber-covered table. The work is placed in ring type fixtures and rotated through an area where blasting is done with walnut shell granules. It is then reversed on the fixtures for a repeat operation.

Balancing of each stator assembly is done on a Gisholt machine while being rotated in a horizontal plane. This machine shows the amount of unbalance and the point where metal must be removed to obtain static balance of the assembly within 0.250 ounce-inch. Metal removal for balance is performed on a Heald machine. The material is cut from the inside circular surface of a step near the rim. To govern the amount of metal that is cut away, the work is offset on the machine. Before final inspection, the assembly is run through a washer and blown off with compressed air.

* * *

Channel-Shaped Grinding Fixture Supports Gib Backing Strip

In an interesting application of a large, horizontal-spindle, planer type grinding machine, a channel-shaped fixture is used to support a gib backing strip. The fixture is designed so that the clamping straps employed at either end serve a double purpose. They not only lock the tool to the machine table but also contact the ends of the work to prevent shifting within the channel.

A row of small-diameter set-screws can be seen along one side of the fixture in the illustration. These screws are used as an additional means of clamping. A lifting ring juts out from the center lug on the same side of the tool.

All necessary grinding—including the sides, the bottom, and a 10-degree beveled face—is handled on the same Mattison grinding machine. The grinding wheel is mounted on a compound slide and can be fed automatically along the cross-rail in steps ranging from 1/4 inch to 4 inches. These feed steps may be taken at either or both ends of the table stroke. A rapid cross-feed of 30 inches per minute is also provided.

Finishing a 10-degree beveled face of a gib backing strip on a planer type grinding machine. A channel-shaped holding fixture is supported on blocks along one side to permit grinding of the angular face.

How to Compensate for Shortage of Engineers

By Alfred M. Cooper

INDUSTRY is experiencing a grave shortage of engineers. This originally acute situation has become chronic, and if we assume continued full employment, the condition cannot be improved immediately.

In prewar years, United States colleges were turning out a superabundance of engineers—in 1938 some thirteen times as many as there were engineers then employed in industry. Technical men were a drug on the labor market and were being hired for every type of menial job.

During and after World War II, the need for technically trained men mushroomed and the colleges attempted to meet the demand. In 1950, there was a peak of nearly 53,000 engineering graduates in the United States, but since then, year after year, the supply has sharply diminished—42,000 graduates in 1951; 30,000 graduates in 1952; and on down to 22,500 graduates in 1955. This—through years when over-all employment has steadily continued to increase, and the need for graduate engineers has risen at an even faster rate—leaves United States industries suffering a critical shortage of 20,000 engineers.

Any lasting cure for shortages of engineers requires better teamwork between those authorities in high schools and colleges who are responsible for vocational guidance and those experts in industry and government whose business it is to prognosticate the rate of growth within industries. As of now, it would appear that our estimates of future manpower needs have all been a bit over-cautious for at least ten years.

In view of the existing situation, it is interesting to note the ingenious methods that have been adopted in compensating for shortages of engineers. Certain of these methods may be utilized in large or small plants; some, because of the cost involved, are applicable only to larger plants.

University Extension Courses

Some plants find it practicable to encourage high school graduates among their employes to continue their education through university extension courses. All tuition costs for such engineering courses are defrayed by the company, and scholarships are awarded to employes who have been selected as demonstrating unusual potential leadership ability. Such men, after graduation, are to be given special consideration for promotion to executive rank.

Personnel officers contend that where it is possible to select and upgrade employes within the ranks it becomes practicable to secure, not only proficient engineers who know their way around the particular plant, but better material for promotion to higher executive positions.

Part-Time Student Employes

Again, where there are universities located nearby, plants are hiring engineering students from these schools as part-time employes, and an effort is made to choose those who will qualify as permanent members of the engineering staff after graduation. This method of meeting shortages has the additional advantage of functioning as an on-the-job orientation school for new engineers, already grounded in company policies and routines. In the smaller plants, this also makes it easier to secure the services of a better grade of engineers.

Obviously, either the upgrading of shop employes or the hiring of part-time student engineers may be preferable as a method of selection to employing bottom-of-the-barrel among the annual crop of engineering graduates. And this may be all that is otherwise available to the smaller plant in a period of shortages of technical help.

Training Assistant Engineers

Again, existing shortages have been alleviated in larger plants by selecting non-engineering graduates among the shop and office employes—preferably those who have majored either in mathematics or physics—and training these as engineers. It has been found that intensive five-month courses can convert such men into engineering assistants who are well qualified. Here again, it is possible to more carefully screen these men for their leadership qualities.

Where such training can be given, it has been found practicable to assign two or three such non-engineering graduates as assistants to engineers, thus, relieving the engineers of much detail

work and freeing them for broader, more vital phases of design activity.

It is also true that personnel executives are beginning to look with definite disfavor on the practice of employing engineering graduates as draftsmen. This time-honored method of inducting engineers into industry is now considered wasteful of skills that are in too short supply. It has been found that high school graduates can be readily developed into competent draftsmen, and this again frees the engineer to concentrate his efforts on legitimate engineering work. It has also been found that too many years of routine grind at a drafting table may hamper the engineer for imaginative design effort.

Full Utilization of Graduate Engineers

Then, too, it has been ascertained that the time of too many engineers is taken up with detail work of a purely clerical nature such as operation of a computing machine. No sacrifice in efficiency results when experienced women computing machine operators are substituted for engineers who have been handling this non-technical work.

In connection with studies of this general shortage problem, it frequently develops that job specifications are found to call for engineering degrees when the work could in many instances be handled by those of lesser attainments. This is a carry-over from the days when there was a surplus of technical help and engineers were used for other jobs.

Whether substituting men and women of lesser qualifications, or upgrading present employes into engineers or assistant engineers—anything that frees the engineering force from duties that can as well be handled by others certainly increases the effective supply of engineering talent available.

Most experts caution that efforts to induct too many non-engineering employes into engineering work may have a deleterious effect upon the quality of imaginative design. In the long run, the answer to engineering shortages must take the form of the guidance of more students into this field. Shortage problems must be met and overcome, but the scarcity should be corrected as soon as possible.

In the United States, there has recently occurred an unfortunate shift of emphasis in high school curriculum building which must, if continued, affect adversely the number and quality of entrants into engineering schools. Nearly 1500 of these high schools last year dropped courses in mathematics and science—courses of study which are, of course, fundamental in preparation for entrance into any engineering college. It would be interesting to know what courses of study were substituted for these.

In time, of course, educational institutions will catch up on shortages of engineers. In the interim, one or more of the remedies suggested, which have been found effective in a number of plants, may help spread the too few engineers over a superabundance of jobs.

In some cases, too, it will be found that the emergency measures that have been put into effect (such as substitution of women computing machine operators for engineers and the employment of non-engineers as draftsmen) may be considered so effective and economical that engineering skill will no longer be dissipated on less demanding jobs. Likewise, any system that is developed for upgrading employes already on the payroll may be well worth continuing in effect. Particularly is this true when such a program has for one of its objectives developing future executives. Industry has never had quite enough material from which to fashion top-flight executives.

In any event, if the existing shortage of engineers results in the development of superior methods of allocating trained manpower to jobs calling for such training, then the emergency may have been well worth while. In the years ahead, it may be dangerous to waste our manpower, and this is particularly true of highly skilled manpower.

* * *

Heat-Treatment of Soft Gear Blanks Improves Tool Life

Tool life in rough-turning gear blanks at the Aircraft Engine Division of the Ford Motor Co., Chicago, Ill., was poor, due to a wide range in the hardness of the forgings, which are made from AMS 6260 steel. In addition, when parts were ready for carburizing and final hardening, distortion was excessive.

As a remedy, semi-rough-turned parts are inspected. Those found not to be within a hardness range of 21 to 28 Rockwell C are given a stabilizing heat-treatment. This additional processing allows better machinability.

Also, gears requiring internal splines are segregated and given a 100 per cent hardness check prior to broaching. Class I parts, having a hardness below 20 Rockwell C, are broached at a low speed to prevent tearing of the splines. Class II, 20 to 24 Rockwell C, are broached at normal speed. Class III, over 24 Rockwell C, are broached faster. All process operations have been changed to include a stabilizing heat-treatment after rough-machining.

Automatic Feeding Device Sorts and Delivers Small Components

Production rates often can be augmented by incorporating automatic handling devices between operations. This article describes a mechanical handling mechanism designed to sort and feed small parts to a tapping machine with the tap-drilled end first.

By W. M. HALLIDAY

LARGE quantities of hollow cylindrical components, such as the one shown at W in Fig. 1, were required to be tapped to a particular depth. Since an automatic tapping machine was to be employed for the operation, it was desirable to provide a feeding device that would automatically deliver the parts with the proper end in position for thread cutting. On this component, the tap was to enter the larger (left-hand) end.

Illustrated at X is the sorting and feeding device that was designed to fulfill this requirement. The mechanism embodies a principle that is applicable to other sorting devices. A delivery rate of up to 240 parts per hour may be obtained.

Machined, cast-iron plate *A* forms the base of the device. At the left-hand side of this member is fastened a chute *B* which has a V-groove formed on its upper surface. A similar V-groove *C* continues across the top of plate *A*. Although the greater portion of the chute is inclined upward at an angle of approximately 15 degrees, to permit gravity feeding of the parts from a hopper, the section that joins the baseplate lies in a horizontal plane.

Groove *C* leads into rectangular opening *D* that is cut through plate *A*. The width of this opening is 1/32 inch greater than the length of the work-piece, and its length is about six times the diameter of the work-piece.

Fitting within a guide way machined along the lower face of baseplate *A* is a long rectangular slide *E*. Screwed to the top of this slide is rectangular block *F*. This block projects through opening *D*, its height extending to the top of the baseplate. With the slide in its forward position, as shown, the rear long side of block *F* is in line with the forward side of the V-groove.

Rectangular slot *G* is machined through slide *E*. The dimensions of this slot are slightly greater than those of the work-piece so that the part may pass through freely. A step, the same width as slot *G*, is machined into the right-hand wall of rectangular opening *D*.

Centrally located within this step, and pressed into the baseplate, is shoulder-plug *H*. A blind hole, with a diameter about 1/32 inch larger than that of the work-piece shoulder, is drilled into the projecting portion of the plug. The mouth of this hole has a large chamfer to facilitate entry of the small end of the part to be sorted.

Situated directly across the opening and in line with this plug is slide *J*. The slide rides in a dovetail guide way cut along the top surface of the baseplate. A hollow cylindrical nose is formed on the right-hand end of the slide. This projection and its bore have the same dimensions as plug *H*. A blind hole is drilled into the left-hand end of slide *J* to receive a light compression spring *K*, which is backed up by block *L*. The spring normally urges the slide to the right so that its nose may project slightly into opening *D*.

Movements of slide *J* are controlled by bar *M* which slides within a guide way cut on the under side of baseplate *A*. Pin *N* is secured in slide *J* and bears against the left-hand side of the bar. The slide is retained in its retracted position by pin *N* resting within a V-notch in the bar.

Movement is imparted to slide *E* and bar *M* through the action of reciprocating connecting-rod *O* and pivoting lever *P*. A dwell period is provided at the end of each stroke of the connecting-rod by a drive mechanism (not shown) attached to the tapping machine.

A slot is cut through lever *P* at a point coincident with the center axis of slide *E*. Pin *Q*, which engages the slot, is pressed into a T-shaped block *R*. This block slides in a similarly shaped guide way cut into one end of member *E*. The guide way is closed off by a stop-plate that is screwed to the end of the slide. Situated within the guide way, between the stop-plate and the sliding block, is

compression spring *S*. The purpose of the spring is to hold the block firmly against the forward end of the guide way. Check-screw *T* is threaded through the stop-plate to provide an adjustment for the rearward travel of block *R*.

A second slot is cut through lever *P*. Shoulder-pin *U* passes through this slot and also through an arcuate slot, having a carefully calculated length, in sliding bar *M*. The reason for this dual linking arrangement of the lever to both slide *E* and bar *M* is to permit the slide to be reciprocated a certain distance before the bar is operated.

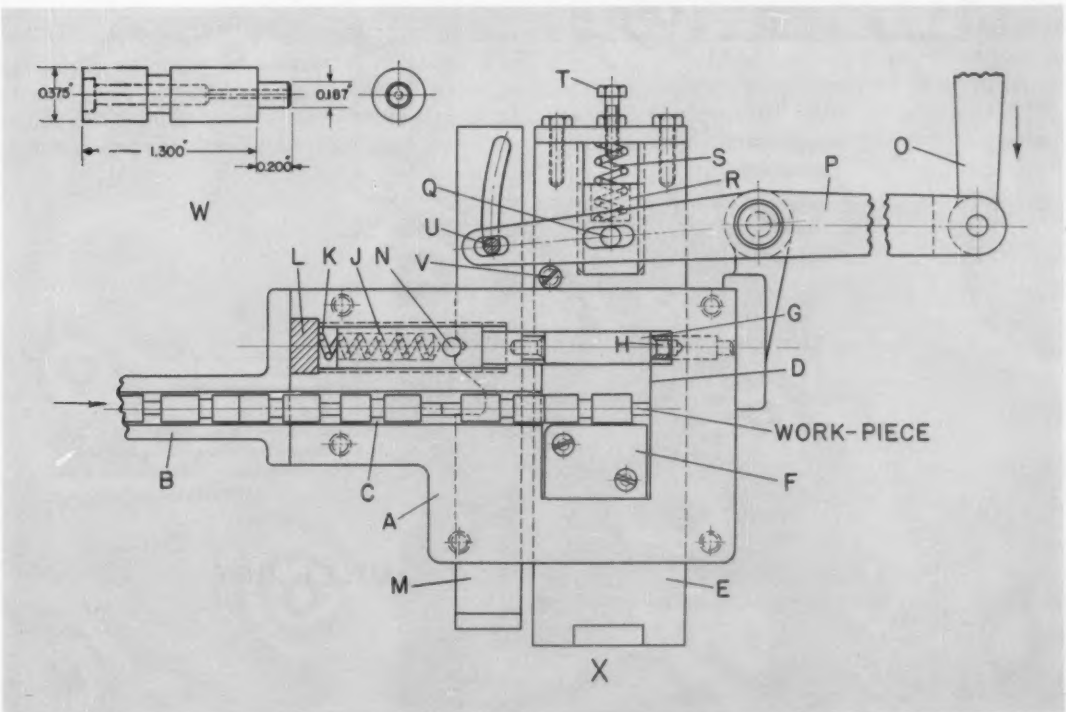
Forward movement of slide *E* is checked by stop-pin *V*, while movement to the rear is checked by an integral ledge on the opposite end of the slide. An integral ledge on the forward end of sliding bar *M* limits the rearward travel of this member, while the engagement of pin *N* in the V-slot along the edge of the bar determines its forward limit of travel. Several small tapped holes are provided in the baseplate to accommodate a cover plate that protects the moving parts from dirt and metal chips.

The diagram at X shows the components of the sorting mechanism in their respective positions at the beginning of a feed cycle. Due to the weight of the parts in inclined chute *B*, the first work-piece is pushed into rectangular opening *D*, where it comes to rest on top of slide *E* and against block *F*. As connecting-rod *O* moves in the direction indicated by the arrow, slide *E* alone is drawn backward, carrying the work-piece to the rear end of opening *D* where it is in line with shoulder-plug *H* and slide *J*. At the same time, block *F* is moved back to a position that closes off the mouth of V-groove *C*, thus halting the flow of parts.

During movement of the main slide, bar *M* remains stationary as shoulder-pin *U* merely slides along the arcuate slot. After slide *E* has completed its movement, bar *M* is drawn backward until pin *N* on slide *J* engages a deep slot on the side of the bar, as shown at Y, Fig. 2. Slide *J* thus advances to the right, under the influence of spring *K*, pushing the work-piece with it. The shoulder of the part enters the blind hole in shoulder-plug *H* as shown.

When connecting-rod *O* begins its reverse movement, slide *E* is returned to the front while bar *M* remains stationary. After the main slide reaches the end of its forward movement, slot *G* is brought immediately below the part. Further movement of connecting-rod *O* actuates bar *M*, with the result that pin *N* is returned to its original position in the V-slot. This action causes immediate withdrawal of slide *J*, permitting the work-piece to drop through the slot *G* and, thus,

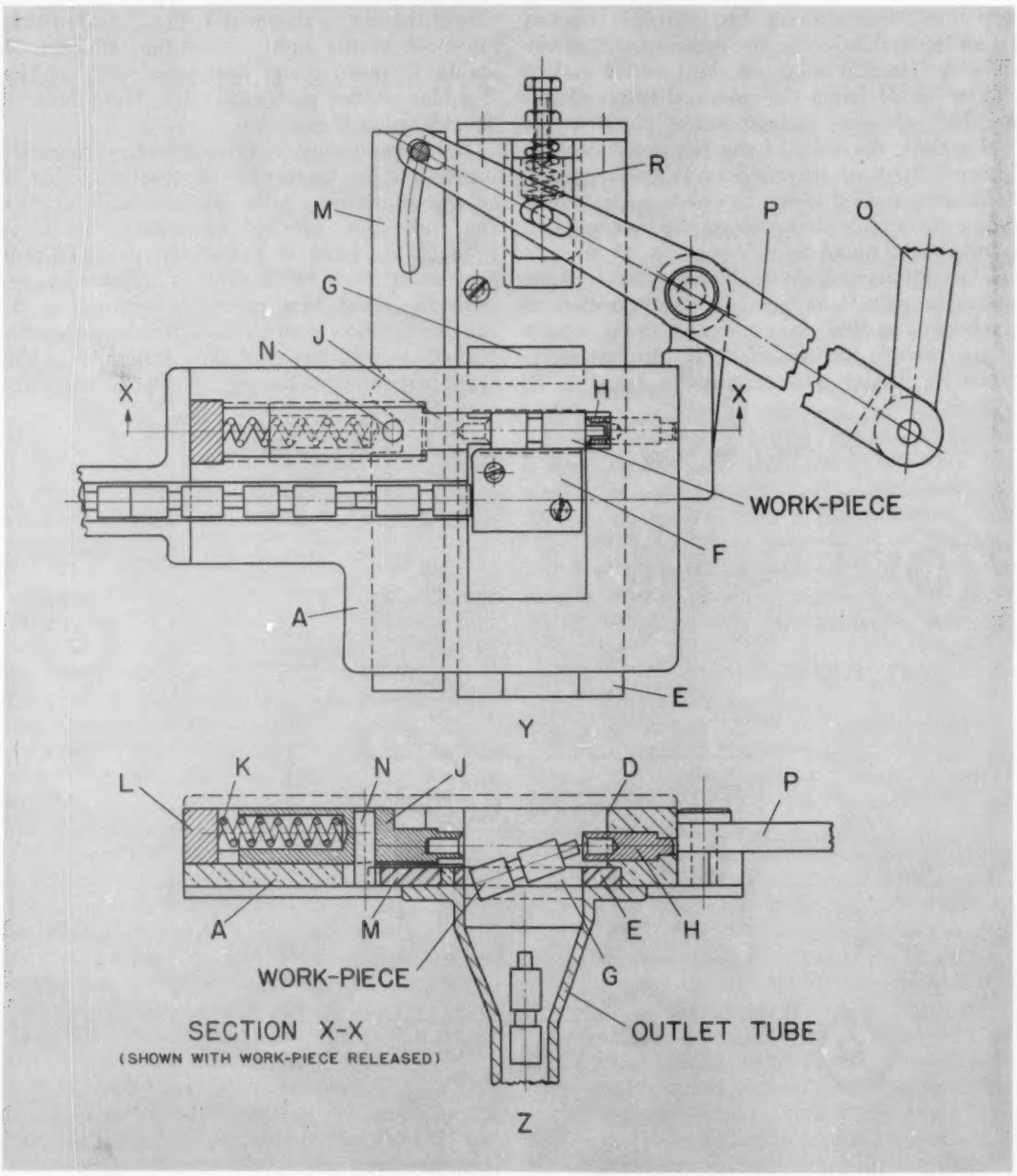
Fig. 1. Feeding and sorting device delivers work-pieces large end first.



out of the sorting chamber. Since the work is loosely supported at its right-hand end by plug *H*, it instantly tilts with its large (free) end downward as shown in Z in Fig. 2. On the under side of baseplate *A* is an outlet tube that receives the parts as they drop through the feeding and sorting device.

Should the work-piece pass into opening *D* in the opposite position from that illustrated, the mechanism will function in essentially the same way. The only difference is that the small diameter end of the part will pass into the blind hole in the nose of slide *J* instead of the hole in shoulder-plug *H*. At the completion of the cycle, the work-piece will fall into the outlet tube with its large end first, as before. To insure continuous delivery of parts to the mechanism, it was found necessary to make the chute leading to the device long enough to accommodate at least fifteen components at the same time.

Fig. 2. Retraction of bar (M) causes shoulder of part to engage hole in plug (H).



Hot Parts for a Turbo-Jet

By ROBERT L. CLARK, Works Manager
Ryan Aeronautical Co.
San Diego, Calif.

PRODUCTION of major components for the Pratt & Whitney Aircraft J-57 turbo-jet engine is now in its seventh year at the Ryan Aeronautical Co., San Diego, Calif. Thirty-six different assemblies for this famous power plant are built. Among them are compressor and turbine cases, flame-holder and combustion chamber weldments, afterburner ducts, and engine mounting cases.

Approximately 75 per cent of the work involved consists of machining. Even the skins have to be precision formed and machined, since all major sections must be butt-welded together. This requires perfect mating at the joints. (Lap-welding is prohibited, to conserve weight as well as to obtain certain other advantages.)

Large H-ring forgings, nearly 3 feet in diameter, weigh 487 pounds as received in the rough condition. In ten operations, requiring nine hours, 397 pounds of metal is removed. The finished assembly, weighing 90 pounds, is precision machined to intricate design within plus or minus 0.002 inch. Various angular and grooved surfaces on the inside of the ring are machined simultaneously with form cutters. The work is handled on vertical turret lathes, seen in Fig. 1.

Of the several sheet-metal alloys in the J-57, a heat-treatable grade that can be hardened to high strength is used extensively. Special forming, welding, machining, heat-treating, and pickling procedures for this alloy had to be devised due to its relatively new application. Because of its high-strength property, the alloy develops considerable localized residual stresses. To prevent cracking, the company laboratory specifies

Fig. 1. The H-rings are reduced to a fraction of their original weight by a series of ten vertical turret lathe operations.

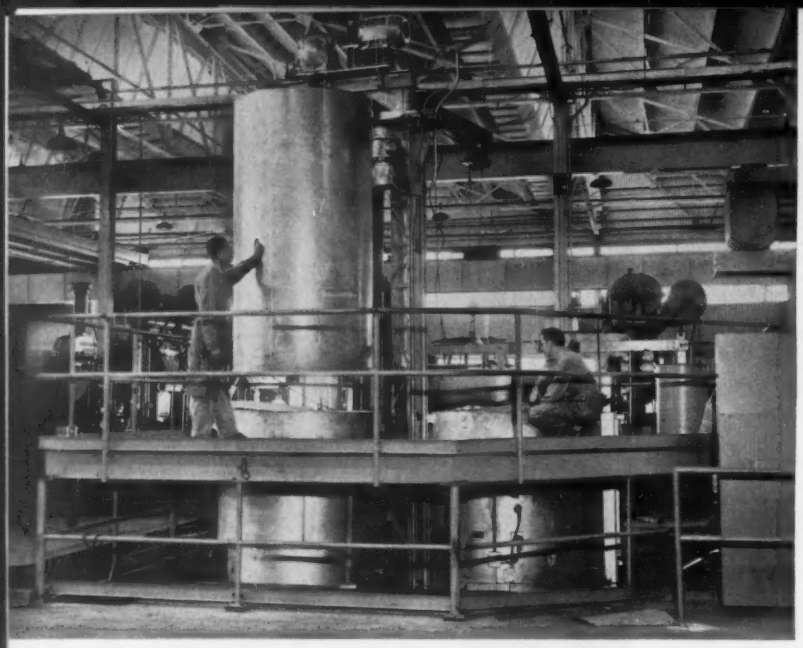


Fig. 2. Heat-treating in the 1800-degree F. controlled atmosphere of these furnaces avoids scale formation on the parts.

that all components of this alloy be stress-relieved within two hours after welding.

The heat-treating is done in a controlled atmosphere at 1800 degrees F. in the General Electric furnaces illustrated in Fig. 2. No scale forms on the parts because of the controlled atmosphere, but a new acid pickling bath was needed to remove the slight furnace blackening that does occur. Sand-blasting was ruled out because of the danger of entrapping abrasive particles in inaccessible areas.

New company-designed fixtures for automatic welding operations afford precise mating of the joints. These are rotating devices with expanding mandrels having removable shoes which hold the parts rigidly. Hydraulic power is used to expand the mandrels. One welding setup is illustrated in Fig. 3.

Motors revolve the work under Heliarc electrodes, where it is accurately butt-welded. Various shoes are available so that a number of parts can be handled in each fixture. All shoes are made of steel and faced with copper, which dissipates the welding heat uniformly, thus holding distor-

Fig. 3. Copper-faced steel shoes are expanded hydraulically to grip the work for a Heliarc butt-welding operation. Fixture rotates work during welding.

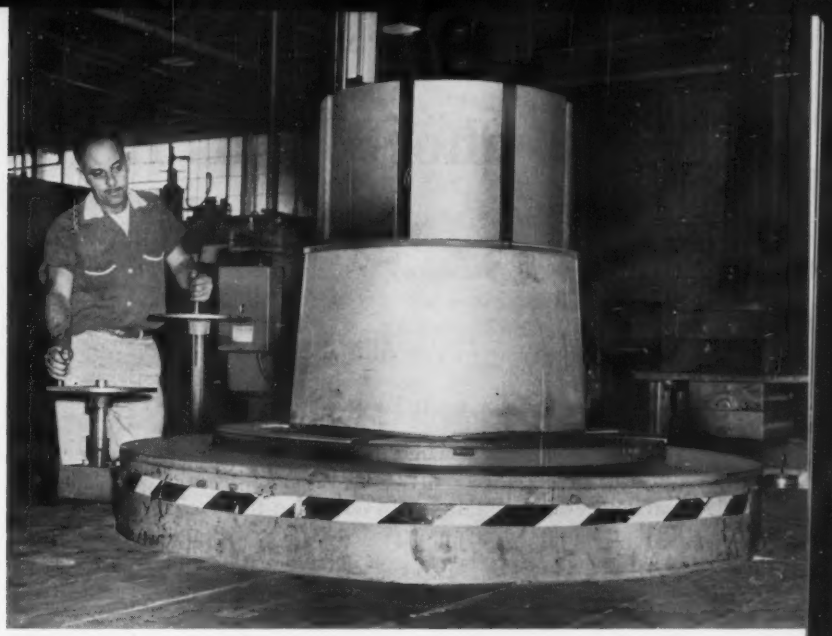
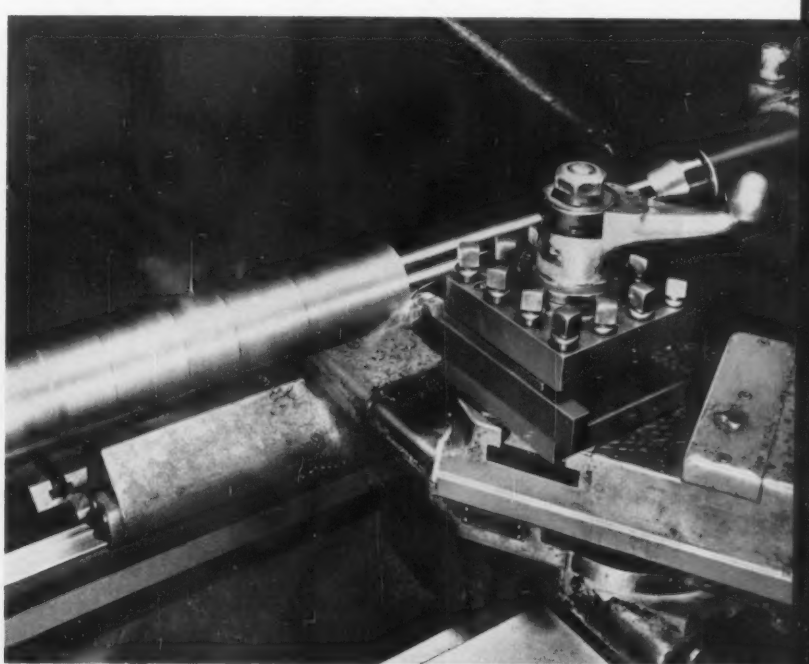


Fig. 4. This company-designed mandrel stretches a circular-shaped weldment to exact diameter after welding the seam.

tion and shrinkage to a minimum. Another type of expanding mandrel stretches circular welded shapes to exact size, as can be seen in Fig. 4. The machine of which this mandrel is a part is able to exert a radial force of 4800 tons.

Tooling engineers have also put expanding mandrels to use in designing special fixtures for machining large J-57 structures. Each mandrel consists of two tapered plugs which move in and out of the part over a control shaft. By exchanging the plugs, different components can be held in the same fixture.

Ryan has instituted time-saving procedures wherever possible. An example is the use of a preparatory stencilling step instead of templates to locate the many spot-welds required in the struts. A non-contaminating ink is employed. The spot-welding operation is shown in progress in the heading illustration. Templates would have required tedious location of the work.



Finish-turning a 31-inch long step-spindle at the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio, at a surface speed of 715 feet per minute. The tool-holder supports a Carboloy Grade 0-30 cemented oxide insert. Cutting time was reduced from six minutes when using a carbide tip to two and eight-tenths minutes when using the ceramic tip. Operating at a surface speed of 350 feet per minute, the carbide tool required sharpening after every twenty spindles as compared with the twenty-nine spindles completed with the cemented oxide tool at the faster cutting rate.

Short Drills Reduce Costs on Special Machine

By BENNIE LEE, Senior Tool Designer
Allison Division, General Motors Corporation
Indianapolis, Ind.

THERE are times when the application of all the precepts of good tool engineering and machine design practice will not solve the problem at hand. Such an experience was encountered recently at the Allison Division, General Motors Corporation, Indianapolis, Ind., with the special machine seen in Fig. 1. This machine had been designed and built to accepted engineering practice, but excessive drill breakage and high maintenance costs occurred. The solution was found by substituting sturdy short drills for the standard length tools originally specified.

The machine was designed to drill 150 oil-holes, 3/32 inch in diameter, through the wall of a large splined clutch hub. The work-pieces are made from SAE 8620 steel forgings that are heat-treated to a hardness of 26 to 32 Rockwell C. Ten single-spindle drill units are placed radially around an index base which automatically positions the part for drilling ten holes at each of fifteen positions. The drills are rotated at 1725 R.P.M., corresponding to a cutting speed of 42 surface feet per minute, and fed at the rate of 0.0015 inch per revolution. The machine was estimated to be capable of producing approximately seven pieces per hour, floor-to-floor time.

It was deemed necessary, because of the small size of the tools, to use a bushing to guide each drill into the work. Furthermore, because the holes have to be drilled in the roots of the spline teeth, it was thought necessary to move the bushings to within 1/8 inch of the surface to be drilled, as seen at the left in Fig. 2. These requirements necessitated both altered standard bushings and means to retract the bushings to allow the part to be loaded and indexed. An air-actuated slide, controlled by limit switches, was provided under each drill unit to position the drills and guide bushings. Improper functioning of this complicated electrical and mechanical system caused considerable down time and high maintenance costs.

Drill breakage was another factor which slowed the operation and made the tool costs excessively

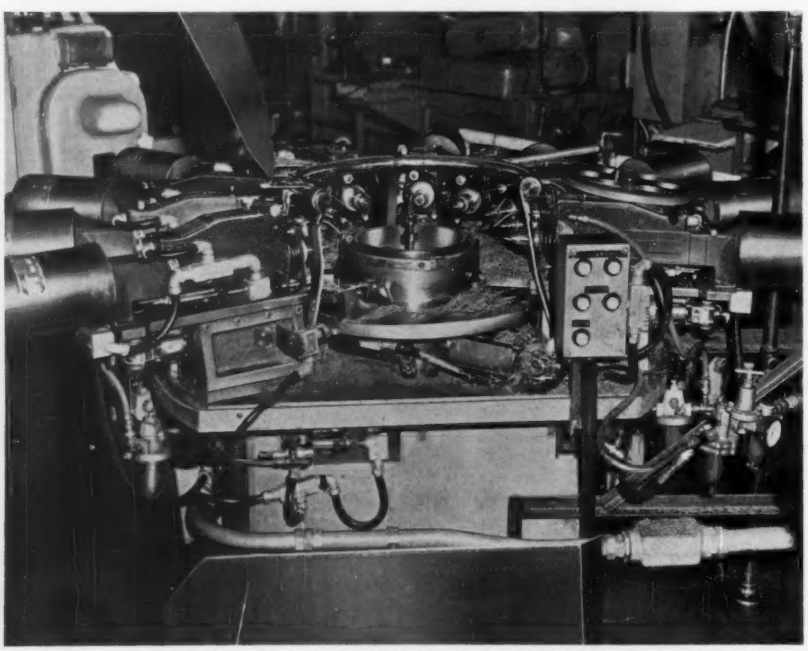


Fig. 1. Special machine for drilling 150 oil-holes, 3/32 inch in diameter, in roots of spline teeth on forged steel clutch hubs.

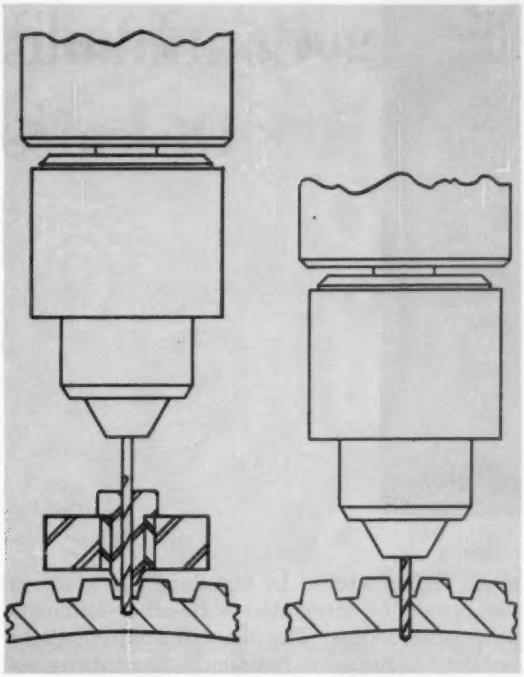


Fig. 2. When standard length drills were used, bushings were advanced, as seen at left, and retracted. Now, with shorter drills (right), bushings are eliminated.

high. The drills used had an over-all length of 2 1/4 inches and a flute length of 1 1/4 inches. However, it was found that fine chips wedged themselves between the drill and the bushing, causing them to break in such a position as to make regrinding impractical.

By substituting drills having an over-all length of only 1 3/4 inches, with a flute length of 3/4 inch and a thick web for rigidity, tool life was increased more than 300 per cent. The drills are chucked just behind the flutes, as seen at the right in Fig. 2, to give a minimum projection. A minor adjustment in rapid advance and feed lengths was required to compensate for the shorter length drills. Because the drill bushings were no longer required, the auxiliary slides with their air cylinders, valves, and limit switches were eliminated. These changes made possible the following savings:

1. Machine cycle time, exclusive of loading, was reduced 75 per cent per piece.
2. Average drill usage per month was reduced from 240 to 46. In cost, this amounted to a decrease from $38.40 to only $5.44.
3. Maintenance time was reduced from an average of 120 minutes per shift to approximately 10 minutes per shift.

New Color Identification System for Steel

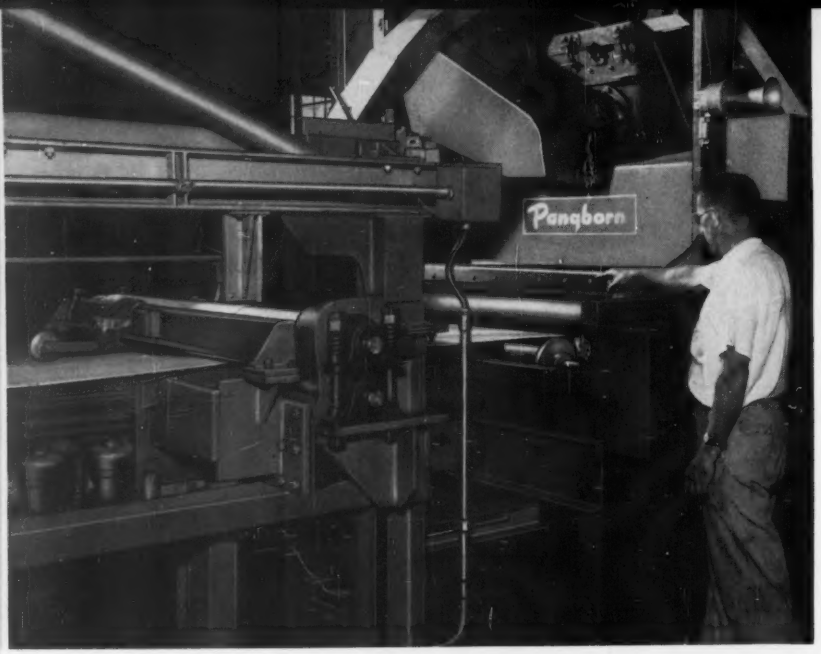
A new series of colors to identify carbon and alloy steels has been developed by Joseph T. Ryerson & Son, Inc. Colors are applied as follows:

1. Single colors are used to identify standard carbon and carbon-manganese steels.
2. Green, blue, yellow, and pink define carbon content.
3. Centered dots on these carbon colors indicate the heat-treated condition.
4. Centered dots on other than these carbon colors identify additional characteristics.
5. Purple, black, white, orange, gold, and brown designate related groups of steels.
6. Red indicates a special ground finish.

Most alloy steels are designated with two colors, one indicating a particular analysis group and the other, the carbon content. Purple, employed as a single color to identify Ledloy (special free-machining carbon-steel screw stock), is used in combination with other colors to designate special free-machining alloy steels in different series. Except for tool-steel bars, which are painted full length, identifying colors for bar stock are painted on one end.

An explanatory pocket-size card, showing the various colors as used singly and in different combinations to identify carbon-steel bars, alloy-steel bars, and steel plates, may be secured without charge from the nearest Ryerson steel service plant or by writing to Joseph T. Ryerson & Son, Inc., Box 8000-A, Chicago 80, Ill.

Alloy steels are identified with two colors, one indicating the analysis group and the other, the carbon content.



Continuous Descales

HOT-ROLLED steel sheets to be used in the fabrication of frames for Chevrolet automobiles must be descaled before they are formed. Acid pickling, formerly used to clean the surfaces of the sheets, has been replaced by an automatic, continuous shot-blasting process at the Granite City, Ill., plant of the A. O. Smith Corporation. Ten thousand tons of sheet steel is descaled each month by this method.

One of the important considerations in the change-over to shot-blasting was the ease with which the continuous Rotoblast descaling machine, manufactured by the Pangborn Corporation, could be integrated with other automatic processing setups. The descaling equipment is installed in the same building as the cutting and forming machines. It is located at the beginning of a continuous production line. Sheets are fed through the machine at a rate of 80 to 160 feet per minute for stock widths ranging from 36 to 40 inches. When stock up to 49 inches in width is descaled, it is fed through the machine at a rate of 90 to 110 feet per minute.

Fig. 1. All descaling operations can be controlled by one man from this centrally located console.

Descaling is accomplished by No. S-170 Tru-Steel shot that is hurled against the sheets by eight Rotoblast wheels. Four of the wheels are located above the work and four below it. About 5 1/2 pounds of shot is consumed by each wheel out of a total of 50,000 pounds of shot thrown during a 16-hour workday. All residual abrasive material is removed from the surfaces of the moving sheets by a blower arrangement.

The surface condition obtained by this shot-blasting system provides good oil retention and coating adhesion. A 10- to 20-minute maintenance inspection of the machine is performed during the lunch period on each shift. Scale and worn-out abrasive are collected at the rate of about 6 1/2 tons over a three-week period.

All descaling operations are controlled by one man from a central console, Fig. 1, from which such factors as the speed of the sheets passing through the machine and the quantity of steel shot thrown can be varied. The steel sheets are automatically fed into the machine from stacks that are loaded on rolls at the start of the line, as

Shot-Blasting Steel Sheets

Fig. 2. Clean sheets leave the descaling machine automatically on a power-driven roller conveyor.

shown in the heading illustration. Descaled material leaves the machine on a power-driven roller conveyor, Fig. 2, that delivers it to the subsequent operations in the production line, which include oiling, slitting, blanking, forming, and assembly.

Surface finishes obtained by this process can be varied by changing the grade of the abrasive and the speed of the impeller wheels. No noticeable amount of base metal is removed by blast descaling.

Various blast patterns can be obtained by shifting the position of the impeller wheels. When narrow sheets are being processed, the blast is directed in a narrow pattern. The amount of shot thrown can be altered by adjusting an orifice plate that is located at the inlet to each wheel. As a result, the sheet can be fed at a faster rate with the same descaling effect. Wider sheets require a wider pattern and a slower rate of feed. In either case, the over-all tonnage of abrasive thrown will remain the same.

Design Efficiency Increased by Use of Standard Tracings

SUBSTANTIAL savings have resulted from the use of standard tracings at the Aircraft Engine Division of the Ford Motor Co., Chicago, Ill. The standard design tracings have all the physical and character aspects of an object but do not show dimensions. Thus, in using the tracings, designers merely have to fill in particular dimensions on a print and it is ready for production.

Use of these prints is especially valuable in aircraft work. The complex machining operations and varied types of material being machined make it virtually impossible to use standard tooling. Specific tools and designs are needed in the majority of cases.

Of the approximately 8000 different tools employed on one completed program, only 30 per cent were covered by standard tracings. However, on a current program involving some 5000 different tools, about 75 per cent are covered. One standard tracing is applicable to many sizes of tools. Wide coverage is, therefore, provided by the 370 standard tracings that have been developed for special tools, such as single-point tools, drills, taps, reamers, end-mills, milling cutters, countersinks, and counterbores.

The time required to complete a tool design varies according to the complexities of the tool. In general, the reduction in design time through the use of standard tracings is estimated to average approximately four hours. With this reduction in time, designers are made available for urgent and more complex requirements.

Materials OF INDUSTRY

The properties and new applications of materials used in the mechanical industries

Easy-to-Grind, High-Titanium Carbide Indicates Long Tool Life

A tough, easy-to-grind, high-titanium carbide with nickel binder, which is indicative of long tool life in precision finishing and boring of steels, was announced by the Carboloy Department of General Electric Co., Detroit 32, Mich. This carbide, called Grade 330, is not quite as hard as cobalt binder type carbides but is equally wear-resistant. Its transverse rupture strength is about 200,000 pounds per square inch and its hardness about 91.5 on the Rockwell A scale. The carbide can be ground easily on duplicating type grinders, and, if accidentally crowded while grinding, will not crack readily. It is not very susceptible to chipping or cracking during machining operations, due to its structure and toughness.

High-Strength Steel Bar Which Requires No Heat-Treating

A high-strength free-machining steel bar which requires no heat-treating has been announced by the La Salle Steel Co., Hammond, Ind. The product has been introduced under the name "Fatigue Proof." It has "in-the-bar" properties usually associated only with heat-treated steels.

This product machines at least 25 per cent faster than annealed alloys and 50 to 100 per cent faster than heat-treated alloys, according to its producer. Distortion from machining is said to be minimum since it is free from locked-up residue stresses. It is uniform in structure, exhibits good wear resistance, resistance to fatigue and service failure, plus a high degree of dimensional stability. Tensile strengths range from 140,000 to 150,000 pounds per square inch with a hardness of approximately 30 Rockwell C.

Blast-Cleaning Abrasive for Producing Etched Finishes

A steel grit blast-cleaning abrasive for producing etched finishes has been announced by Wheelabrator Corporation, 1147 S. Byrkit St., Mishawaka, Ind. Known as "Steeletts," this grit is made of high-carbon electric arc furnace steel, specially heat-treated to provide the toughness required for blast-cleaning operations. It has the same hardness range as chilled iron abrasives but is free from brittle carbides. These particles do not chip upon impact and the shape endures for hundreds of cycles.

The grit is used to provide a deep etch on metallic surfaces for bonding, to provide luster on non-ferrous work by exposing virgin metal and giving it a matte type surface, for descaling alloy forgings and heat-treated work, and for etching steel mill rolls. Seven sizes of Steeletts are available ranging from G-16 down to G-120 size.

Additive for Industrial Lubricants, Oils, and Greases

An all-purpose industrial lubricant additive has been announced by Destiny Products Co., 2970 W. Grand Blvd., Detroit 2, Mich. This product, called "Hyperoil," is a compound of halogen and cresyl components, coupled with certain phosphates and oxygen-bearing materials. It contains no sulphur, graphite, or bodying agents of any type. The additive is devoid of abrasives and is completely chemical in formulation. It is heat-resistant and can be used at temperatures as low as minus 85 degrees F. Hyperoil is a good rust preventive and metal preservative. It can be stored without ill effects under all temperature conditions.

Nylon Tubing Solves Maintenance Problems on Metalworking Equipment

A flexible nylon tubing of high burst rating has been found highly useful on metalworking equipment in conveying lubricants, water, plastic spray, and air. This tubing, known as "Nylaflow," has been made available by the Polymer Corporation of Pennsylvania, 125 N. Fourth St., Reading, Pa. It has an outside diameter of 1/4 inch, a 0.050-inch wall, and a burst rating of 2500 pounds per square inch.

The material can withstand more than 400 flexes per minute without failure. In some installations, it has been in constant service for more than twelve months without failure. It has a minimum bend radius of 2 1/2 inches and is easy to cut and install, using standard fittings. In addition to its flexibility, high resistance to flex fatique, and high burst strength per unit weight, it is mechanically strong and resistant to abrasion and impact. It is completely unaffected by alkalies and practically all solvents. Furthermore, it is impervious to oil, gasoline, greases, and hydraulic fluid and can thus serve as a medium to carry all of these materials. Although it retains its shape and much of its strength at temperatures as high as 475 degrees F., it is best suited for long-term use below 180 degrees F.

Epoxy Resin Adhesive with Good Impact Resistance

An epoxy resin adhesive which will permanently bond ferrous and non-ferrous metals, glass, wood, rubber, and plastic surfaces to themselves and to each other has been announced by the H. B. Fuller Co., 181 W. Kellogg Blvd., St. Paul 2, Minn. "Resiweld," as it is called, is a two-component system comprised of an epoxy resin and a resin type catalyst. The bonds formed are permanent, have high strength and good impact resistance.

Resiweld is resistant to solvents, grease, water, chemicals, and severe conditions of treatment and exposure. It sets and cures without the use of clamps. Curing time is approximately twelve hours at room temperature or twenty minutes at 300 degrees F. The adhesive is particularly suitable for manufacturing, assembling, laminating, and repairing where high-strength permanent structural bonds are required.

Rust-Preventive Spray for Tools, Molds, and Dies

A rust-preventive spray for use on tools, molds, dies, instruments, etc., has been made available by Eastern Aerosol Products, Newfoundland, N. J. Known as "Rust Chek," the compound is packaged in a 12-ounce aerosol spray container that provides approximately 80 square feet of coverage in the form of a clear, dry, waxy film with a thickness of 0.0005 inch. The film is worked off in the using, and in some applications, such as on power saws, it serves as a lubricant. A surface treated with this material will not absorb dust or dirt. Tests indicate that the product will provide complete protection for tools, dies, molds, machinery, and metal surfaces during storage periods or in transit under the most adverse atmospheric conditions.

Hollow 6066 Aluminum Bar Stock Facilitates Low-Cost Machining

The availability of hollow aluminum bar stock of 6066 analysis has been announced by Harvey Aluminum, 19200 S. Western Ave., Torrance, Calif. This material makes it possible for producers to turn out aluminum machine parts economically. The bar exhibits good machinability, good corrosion resistance, high strength, and good finishing characteristics. The manufacturer claims that there is better chip control when using this material, with correspondingly less handling and processing.

This aluminum stock is available in standard round hollow bars. Sizes obtainable range from 1 inch through 3 1/2 inches outside diameter, with wall thicknesses varying from 0.109 to 0.500 inch.

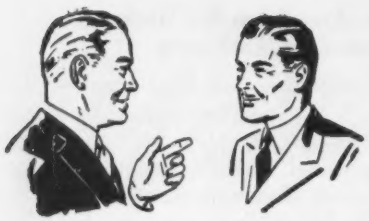
Factory-Sealed Grease Cartridges Facilitate Greasing

In order to enable grease to be handled with speed, efficiency, and economy, the Tower Oil Co., 300 W. Washington St., Chicago 6, Ill., has introduced a factory-packed grease cartridge and gun. The grease gun is loaded with a 1-pound cartridge of grease called "Tower Grezall." This cartridge eliminates the work, waste, and inconvenience of filling from a pail or drum. It also helps to prevent the deterioration and contamination of grease by dirt, grit, and moisture. Cartridges are loaded in approximately thirty seconds, and the gun is capable of delivering a pressure of 10,000 pounds per square inch with a light pumping action.

Liquid-Chemical Grinding Aid Prolongs Abrasive Belt Life

A liquid-chemical grinding aid which prolongs the cutting life of abrasive belts and also provides a good surface finish to the metal being ground has been announced by the Coated Abrasives Division, Armour & Co., Alliance, Ohio. "Armor-Kut (R)," as it is called, is an oil-like substance but not a water solution. It is a heavy red liquid having the consistency of honey, and is used most conveniently at temperatures in the neighborhood of 120 degrees F. The temperature of the liquid is maintained by means of a simple immersion heater in the oil reservoir of the abrasive belt machine.

Best results are obtained by introducing the liquid as a stream to the surface of the belt, prior to contact with the work. It can be used with abrasive belts that have glue bonds and/or non-waterproof abrasives. Good results have been obtained using this material for finishing titanium.



Talking With Sales Managers

By BERNARD LESTER
Management Consulting Engineer

Multiplying the Purpose of the Sales Call

IN developing sales engineers, management usually dwells on sales techniques to be applied to the prospect from first approach clear through to closing the order. Important as this may be, management often neglects to examine the scope and breadth of sales performance during each repeat call. There are several reasons why emphasis should be placed on making each plant call contribute more and more to creating an environment favorable to the supplier.

Equipment sales engineers call mainly on factories, which are rapidly multiplying and moving to the suburbs and the countryside. There are now more people at any one plant influencing the purchase of new equipment. Besides, all of us know what a small share of working time the salesman actually spends in selling, with the rest consumed by coming and going, waiting, and paper work. For these reasons, every sales manager should be alert to multiplying the purpose of the call.

A young sales engineer was asked to review the purpose of one of his sales calls. He was incisive—a clever "opener and closer." Even so, his sales manager suspected he was not making the plant calls effective because they lacked breadth. He could cover one subject well, but having done that, he was inclined to close his brief case and run for his car. He was not securing each customer's good will and business.

This sales engineer proved to have something of a single-track mind. His active pursuit of business was based on depth and penetration applied to only one problem or job. He was a "single-purpose-call-man" and, as such, very good. Only in spots was he developing a relationship conducive to long-term sustained acceptance of his company, all his products, and himself.

This single insistence led to further investigation in connection with each engineer's selling effort. It was found that several men were cleverly engineering the application of equipment but were not engineering the application of their own time spent at the customer's plant with respect to a variety of ideas that might be profitably implanted.

This led to working out the various elements of purpose relating to an ideal sales call. Although the ultimate object of any sales call is to get an order, opinion and decision thrive or die in an environment which the salesman himself can take part in creating.

A single call can cover only a few subjects. However, repeated calls, if well planned, can cover a wide variety of subjects which dovetail into one another. Adding, piece by piece, to a jigsaw puzzle, you finally get a complete picture.

It was found that the purposes necessary to sales calls can be classified thus:

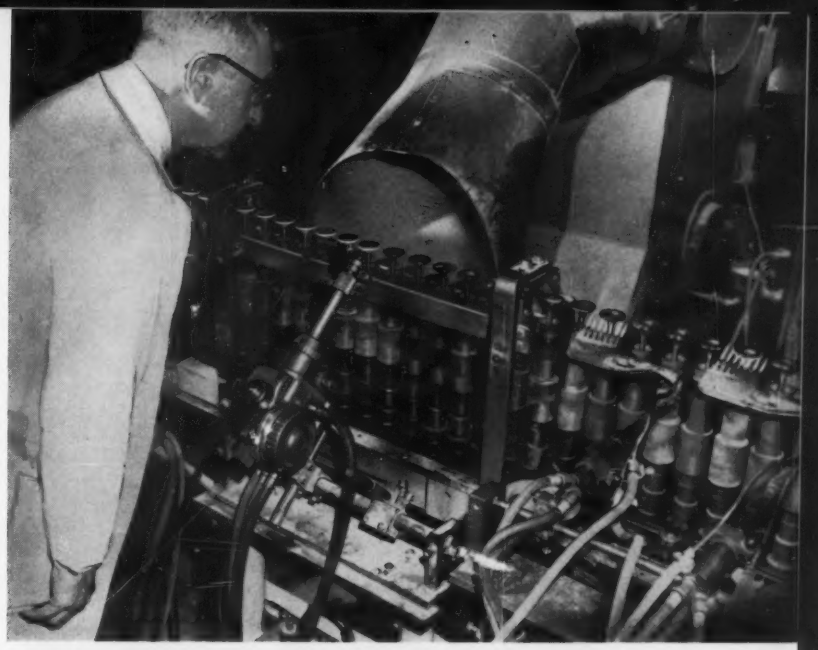
1. To sell a particular product, system, or service.
2. To elevate the reputation of the company and all that it does by citing its accomplishments and describing its facilities.
3. To strengthen customer relationship by every form of help—cheerfully rendered—which meets customer's needs.

Under these main heads were itemized all the ideas the sales engineer might present.

The sales manager wisely called a sales meeting and devoted much of the time to the subject of "How to Make the Plant Call More Effective." In a discussion of this subject, great care was exercised not to discount the importance of selling the active job. But, it was stated that while at the plant the sales engineer should broaden his efforts so as to sell his company and its services beyond the limits of single equipment or application requirements.

The sales promotion manager not only added much to the discussion, but he himself learned of many things his company was doing which possessed human interest. He learned too of the changing interests of customers. His advertising program also had a broader approach. In fact, from a complete review and discussion of a broader program of selling, new life and a new interest took hold of the sales organization.

Metallizing Integrated in Valve Making



METALLIZING—generally thought of as a reclaiming process—is an integral part of valve manufacturing activity at Thompson Products, Inc., Cleveland, Ohio. This company is an important supplier of valves for internal combustion engines. To protect the valve-seat surface from burning and wear, it is coated with an aluminum amalgam.

Previously, valves were loaded manually into trays and dipped first in a hot salt flux, lowered further into molten aluminum, quenched, and then rinsed in a series of hot-water baths. Production was slow and limited by the size of the coating tank.

Working closely with the Metallizing Engineering Co., Westbury, N. Y., Thompson successfully converted its entire valve coating procedure to application by means of a spray gun, as can be seen in Fig. 1. Valves are placed head up in individual carriers and move through an acetylene flame (seen on the right in the illustration) for pre-heating, and then to the metallizing station. Rotating, they receive an even coating of the aluminum wire being fed through the spray gun. In Fig. 2 is a view of the valves after leaving the spray. The valves are next loaded into trays and conveyed through a hot salt flux bonding tank, vibrated to remove excess aluminum, and rinsed.

Advantages claimed for the metallizing application, in addition to economy of time and labor, are a more uniform coating and a greater degree of safety for operating personnel.

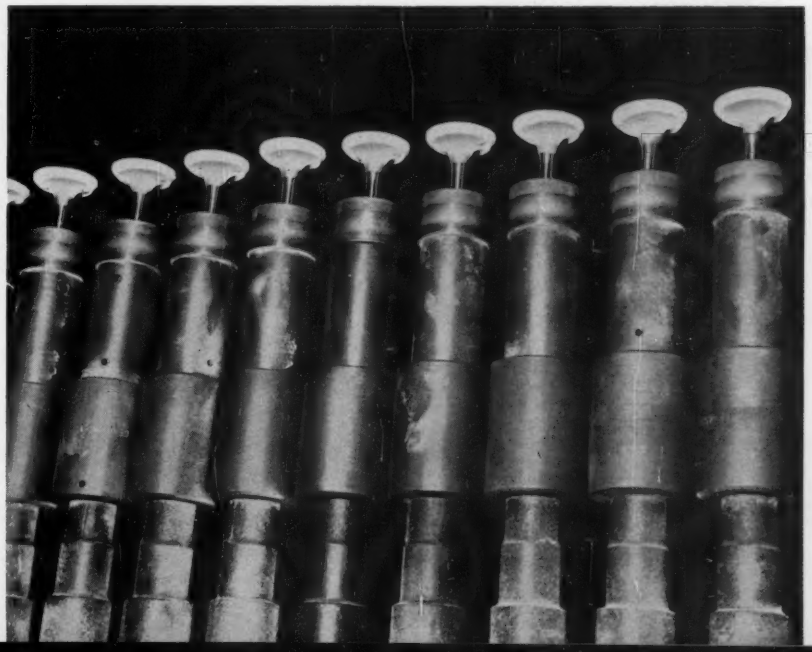
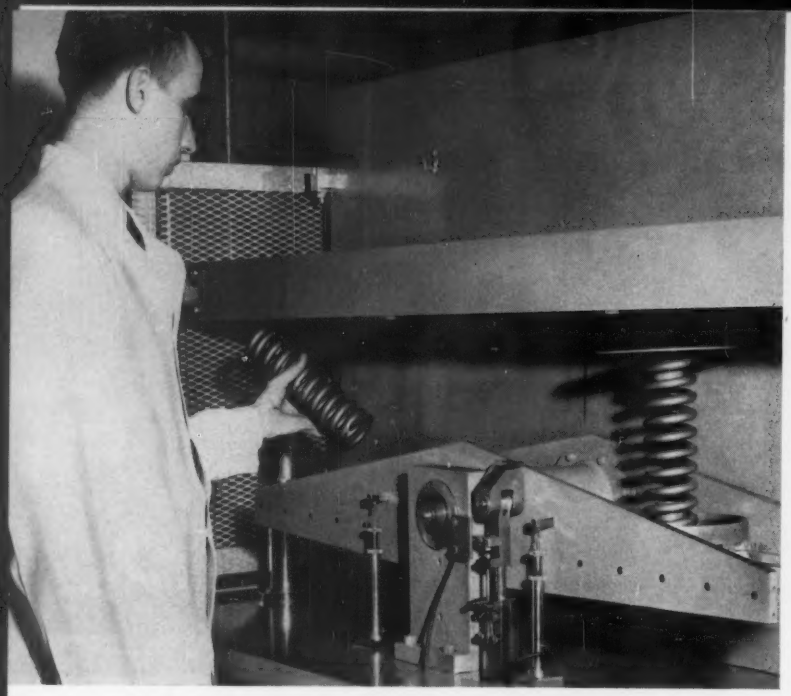


Fig. 1. (Above) The pre-heated valves advance and rotate at the metallizing station.

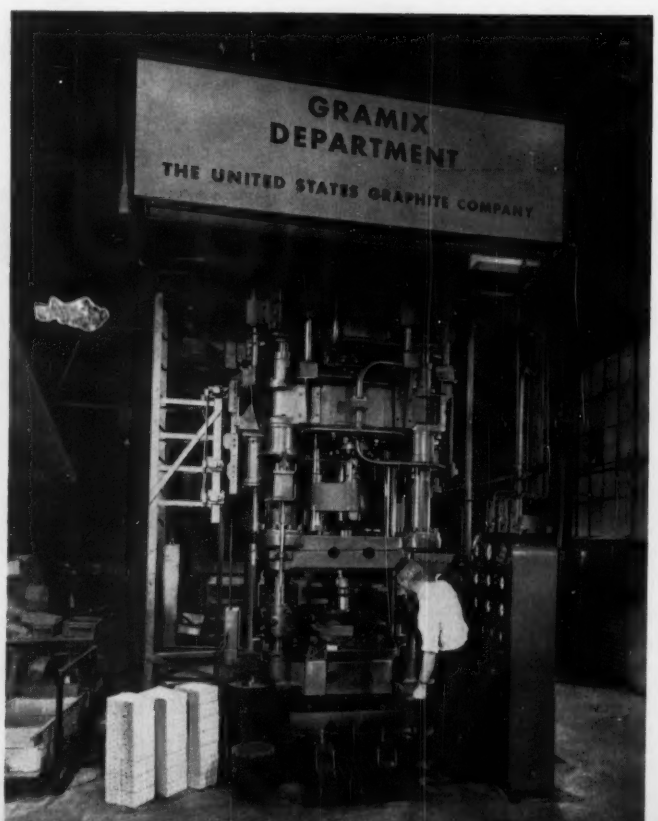
Fig. 2. (Left) A uniform coating of aluminum can be seen on the seat surface of the valves after metallizing operation.



Heavy railroad coupling springs are loaded for testing in a variable-stroke compression machine in the new fatigue laboratory of U. S. Steel's American Steel and Wire Division, Cleveland, Ohio. The machine can test two springs at a time, each with a compression as high as 7500 pounds and speeds to 1500 cycles a minute.

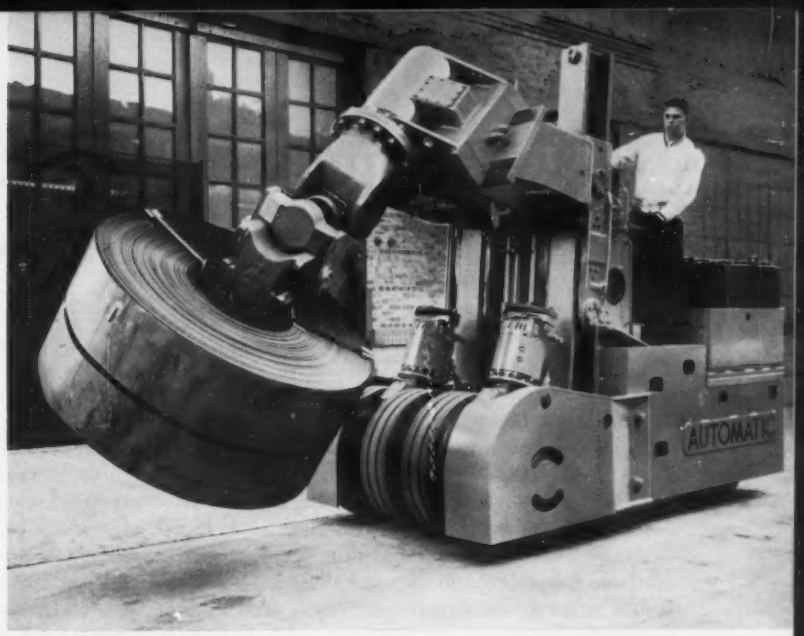
In Shops Around the Country

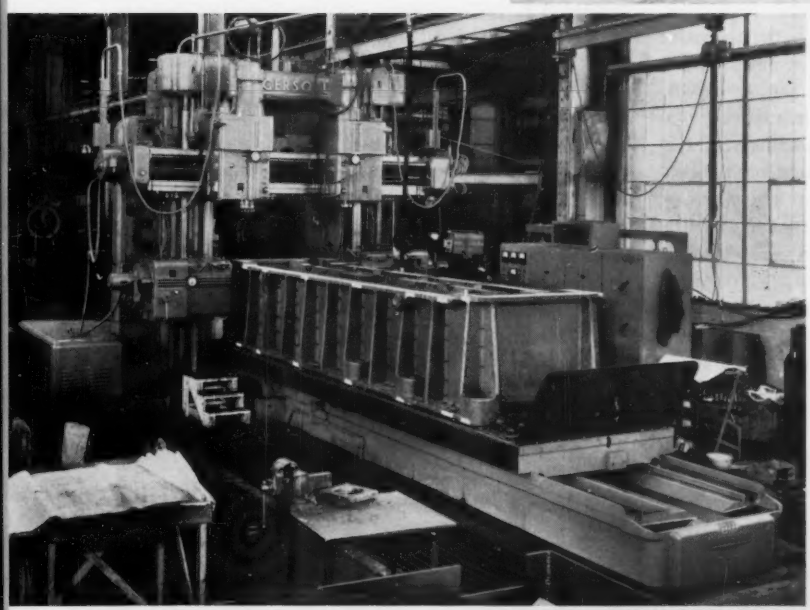
Camera highlights of some interesting operations performed in various metalworking plants throughout the nation



A 300-ton, multiple-action, hydraulic compacting press is now at work in the Gramix Department of the U. S. Graphite Co., Saginaw, Mich. The press was designed and built by Baldwin-Lima-Hamilton and is believed to be the largest of its kind to compact metal powder for sintered bearings and other parts.

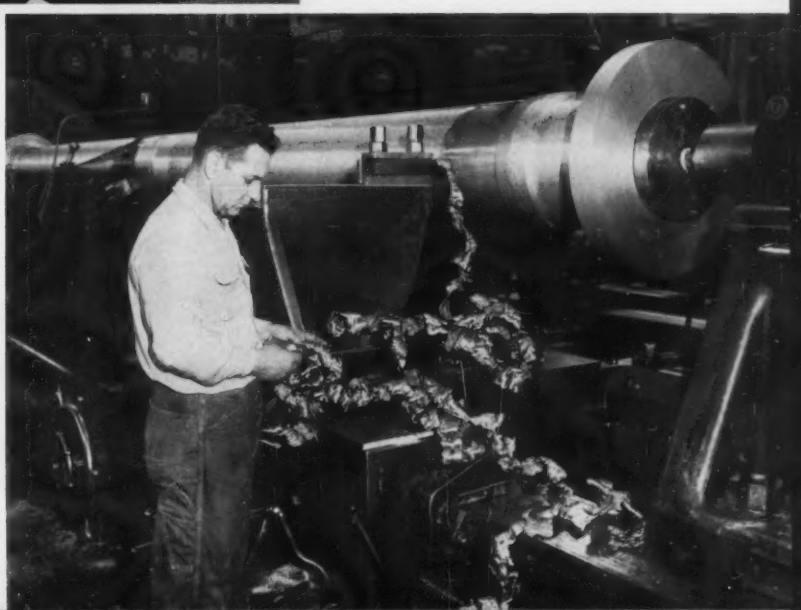
At the Automatic Transportation Co., Chicago, Ill., an industrial electric truck with a coil up-ender attachment goes through its paces prior to delivery. The equipment will lift, transfer, and stack coil stock in a steel rolling mill. It eliminates the need for a stationary coil up-ender customarily installed as part of the mill itself.





Milling a 20-ton bottom drive case for a wide flange beam straightener at the Wheeling (W. Va.) Works of the Continental Division, Blaw-Knox Co. The casting illustrated is the first to be handled on the new equipment, an Ingersoll 24-foot, adjustable-rail, planer type milling machine.

High tensile strength is evidenced by the unbroken 37-foot ribbon, thin as cigarette paper, coming off a marine shaft being turned at the Erie Forge & Steel Corporation, Erie, Pa. Three such shafts—17 3/4 inches in diameter and 27 1/2 feet long—form the drive assembly for a Navy battleship under construction in the yards of the Bath Iron Works.



Tank Cupolas Drilled and Tapped on Transfer Machines

By T. J. Becker, Chief Engineer
Michigan Drill Head Co.
Detroit, Mich.

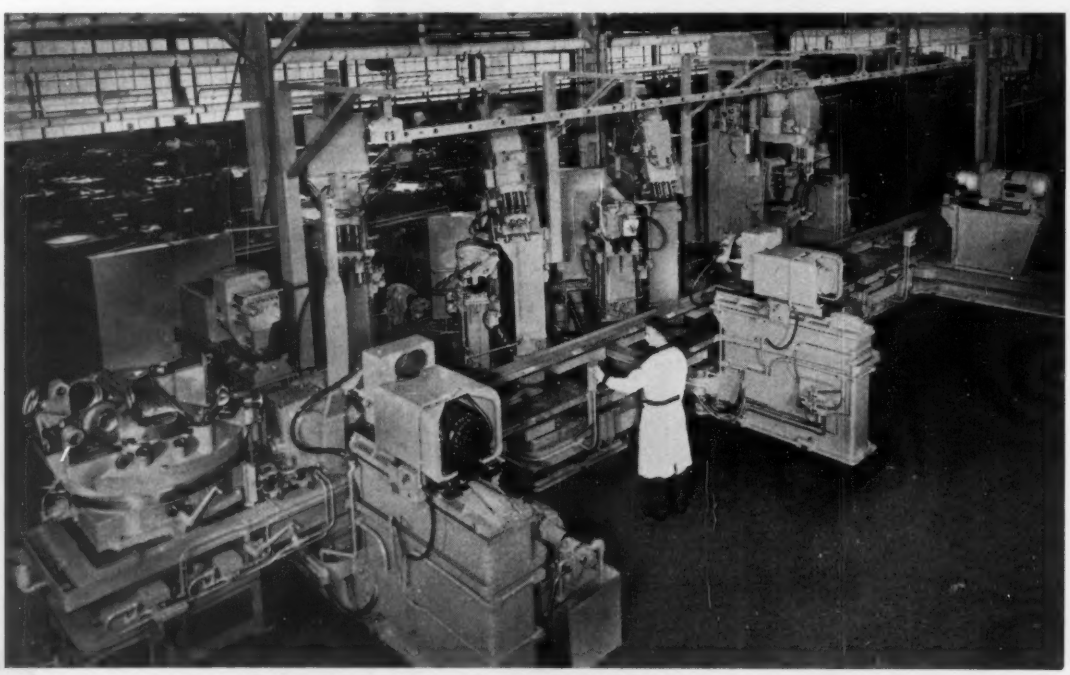
ALL the holes in the 500-pound cupola for a military tank are drilled, chamfered, reamed, and tapped on two in-line transfer machines recently built by the Michigan Drill Head Co. The holes are required for the gun-cradle mounting, hatch hinge, periscope mounting, both inside and outside prism mountings, and cupola mounting flange.

Each cupola is first loaded in a fixture on the eight-station transfer machine seen in Fig. 1, with the bearing race of the work-piece facing down. This fixture is mounted on a hydraulically operated indexing table. Since it is necessary for the part to be moved to irregularly spaced positions and to employ different spacings at the various stations, hydraulic power supplied to the table is controlled by a hand-operated valve. The indexing table is located in the desired rotary positions by means of shot-bolts.

A hydraulically powered carriage moves the table from station to station, and is automatically secured at each station by shot-bolts. To transfer the carriage, the operator withdraws the bolts by means of a lever and starts the carriage in motion with a hand-operated valve. The carriage automatically stops and is secured at the next station, so that it is not necessary for the operator to walk along the machine with the carriage. Power for the electric motor which drives the hydraulic pump is connected to the carriage by means of an overhead trolley.

After the part has been clamped in the fixture, the carriage is moved to Station 2, where two horizontal and one angular drilling units are employed to make three passes. In the first pass, the rear horizontal unit drills five holes 11/16 inch deep and one through hole in the right-hand gun-cradle flange; the front horizontal unit drills

Fig. 1. Eight-station transfer machine for drilling, chamfering, reaming, and tapping various holes in tank cupola seen mounted on fixture at left.



four holes 5/8 inch deep and one through hole in the left-hand gun-cradle flange; and the angular unit drills six holes 29/64 inch deep in one angular prism boss.

The indexing table is then rotated to bring the second angular prism boss under the drilling unit. In this position, dogs on the table contact limit switches which make the two horizontal units inoperative while the angular unit makes its second pass. The table is rotated once more, the third pass is made with the angular drilling unit, and --without indexing the table--the carriage is moved to the third station.

Here, three passes are made with one horizontal and one angular drilling unit. During the first pass, the horizontal unit drills and chamfers four holes in the hatch-hinge boss while the angular unit is chamfering the six holes in one angular prism boss that were drilled at Station 2. For the second and third passes, the table is indexed and only the angular unit operates, chamfering the six holes in the other angular prism boss.

At the fourth station, two lead-screw tapping units (one horizontal and one angular) and one horizontal drilling unit are provided. During the first pass, only the angular tapping unit operates, internally threading the six holes in one angular prism boss with 3/8-24 threads 3/8 inch deep. In the second pass, the angular tapping unit duplicates this operation in the second prism boss, while the horizontal unit chamfers four holes and reams one hole in the left-hand gun-cradle flange. The six holes in the third prism boss are tapped by the angular unit, and four holes in the hatch-hinge boss are tapped by the horizontal unit during the third pass.

When the carriage has been transferred to Station 5, it is necessary for the operator to index the table to a fourth position. Here, a standard Michigan vertical drilling machine is equipped with a combination drilling and tapping head. In one pass, the tapping portion of the head is automatically made inoperative while four holes in the periscope mounting boss are drilled and chamfered by means of special subland drills. During the second pass, these four holes are tapped with 3/8-16 threads while the subland drills pass through an opening in the cupola. Electrical interlocks prevent operation if the table is inadvertently positioned to perform the second pass first. Also, the taps are protected, if for any reason the holes have not been previously drilled, by using Scully-Jones compression type tapholders.

Further indexing of the table is not required for subsequent operations. At the sixth station, a horizontal unit chamfers five holes and reams one hole in the right-hand gun-cradle flange. Two horizontal lead-screw units are located at Station 7 to tap four holes in the left-hand gun-cradle flange and five holes in the right-hand flange. After the tank cupola has been unloaded at the eighth station, the operator reverses the hand valve, thus returning the carriage to the loading station without any intermediate stops.

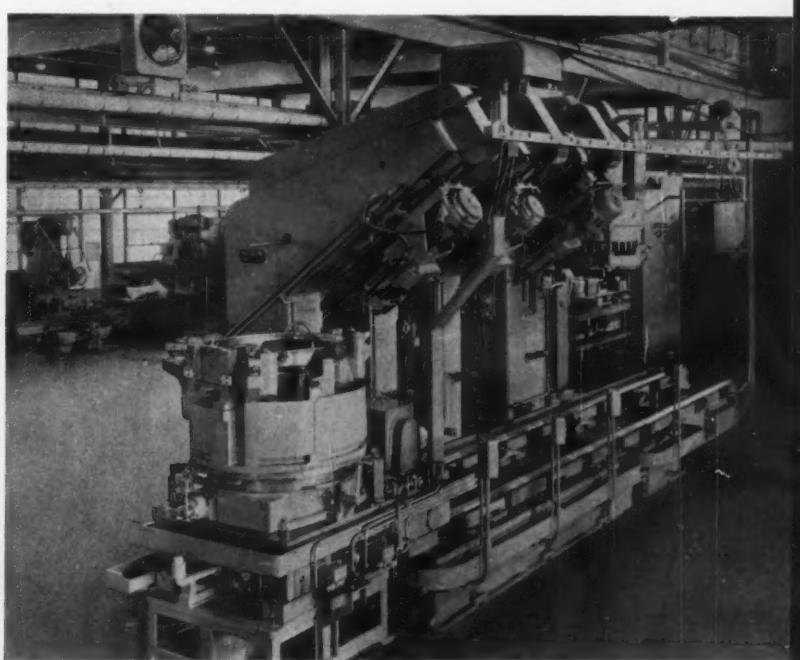


Fig. 2. Three holes in each of three angular prism bosses and thirty holes in the cupola mounting flange are drilled, chamfered, and tapped on this transfer machine.

The tank cupola is then inverted and loaded, bearing race up, in a fixture on the six-station transfer machine shown in Fig. 2. As on the first machine, the fixture is mounted on a rotary indexing table, and the table is held on a hydraulically powered carriage. A drilling unit, mounted at an angle of 35 degrees with the horizontal, is suspended from the under side of an overhanging column at the second station so that it can be fed inside the work-piece. This unit drills two holes and drills and chamfers one hole on the inner surface of one of the angular prism bosses during each of three passes.

Machining units at Stations 3 and 4 are also mounted at the same angle from overhanging columns for performing internal operations. The holes drilled in the three angular prism bosses at the second station are chamfered and counterbored at Station 3 and tapped (1/2-20 threads) at Station 4.

A thirty-spindle, combination drilling and tapping head is mounted on a standard Michigan vertical drilling machine at the fifth station. Here, thirty holes in the cupola mounting flange are drilled, chamfered, and tapped (3/8-24 threads) in five passes. During the first pass, ten of the holes are drilled while ten more are spot-drilled, thus forming the chamfers for holes to be subsequently drilled. Dogs on the table contact limit switches to make the tapping spindles inoperative during this operation.

After indexing the table, a second pass is made to drill the ten holes previously spot-drilled and spot-drill ten additional holes. In the third pass, the last ten holes are drilled, the ten holes which were first drilled are chamfered, and ten holes are tapped. During the fourth and fifth passes, the remaining twenty holes are tapped, ten at a time. At the sixth station, the cupola is removed and the carriage returned to the loading station.

In drilling and chamfering the various holes, which vary from 0.201 to 0.625 inch in diameter, the tools on both machines are rotated at a cutting speed of 30 surface feet per minute and fed at rates varying from 0.0045 to 0.0095 inch per revolution. For reaming, the tools have a rotary speed of 24 surface feet per minute and are fed at the rate of 0.0136 inch per revolution. The taps have a cutting speed of 20 feet per minute and are fed by lead-screws.

An interesting design feature on the first transfer machine (Fig. 1) is that each station has a separate base with its own coolant and chip-disposal system. The bases are connected only by the rails, rail stands, and coolant-drip troughs. This arrangement makes it simple to either alter the sequence of operations or add new stations.

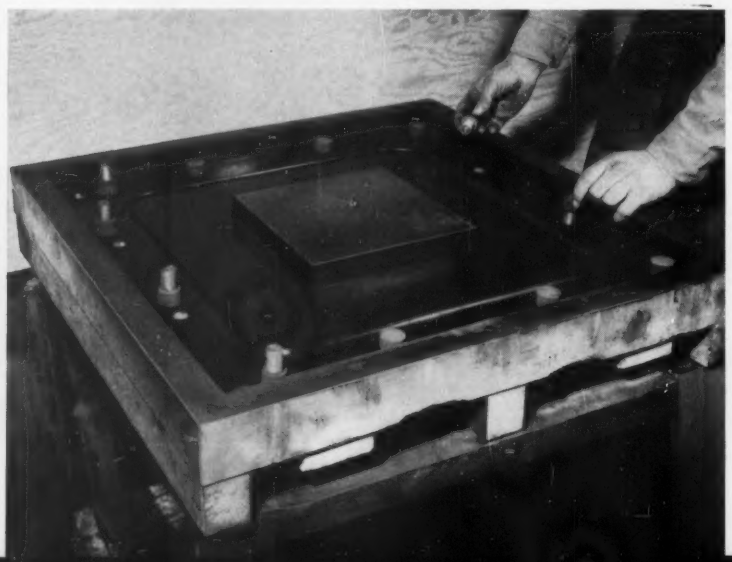
On the second transfer machine, Stations 2, 3, and 4 are all contained on one base so that the length of transfer could be kept short, and also because there was little chance that a change in sequence of operations would be required. This base has a single coolant and chip-disposal system. Station 5 has its own base, and other stations could be inserted between the fourth and fifth stations.

On both machines, the coolant systems are actuated by cam-operated valves. As the carriage moves into a station, it opens a master valve. Also, just before each machining unit starts the feeding portion of its cycle, a valve opens automatically and supplies coolant for the tools. All machining units can be cycled individually.

° ° °

Stainless-Steel Threads Cast into Gray Iron

A method of obtaining corrosion-resistant stainless-steel threads in gray-iron castings has been developed by the E. L. Le Baron Foundry Co., Brockton, Mass. Heli-Coil stainless-steel wire thread inserts are placed in the mold on sand cores. The hot metal flows around the outside of the inserts forming a close bond. Standard blast-cleaning equipment removes the cores from inside the inserts, providing permanent threads of stainless steel in the gray-iron casting.

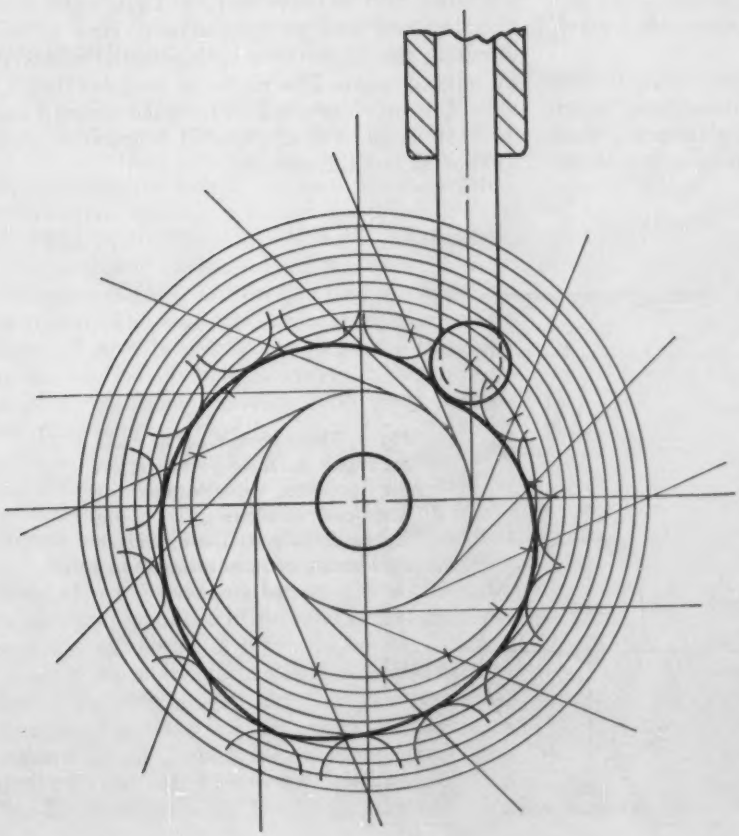


Baked sand cores with stainless-steel wire thread inserts are placed in holes drilled in large core-box

MACHINERY'S Reference Section

August 1956

ELEMENTS OF CAM DESIGN



Part 1

By
Robert V. Nicolosi

Elements of Cam Design

In most automatic systems, various cams can be found that, either singly or collectively, transform a source of mechanical motion to accomplish a labor-saving task. The shape or curve of the working surface of a cam is designed to develop the preconceived motion. First of two installments

By ROBERT V. NICOLOSI

ALL design engineers are confronted, at one time or another, with a mechanical motion problem that can be resolved by the use of a cam. This article presents the basic elements of cam design which are necessary to achieve the transformation of simple rotary motion into any combination of mechanical movements.

Rotary cams can be divided, according to their mechanical construction, into three basic types: face-cams, cylinder-cams, and plate-cams. Each has its specific application. The face-cam, shown at W in Fig. 1, contains a closed groove that is either machined or cast into its face, perpendicular to the axis of rotation, and by which the follower is directed. A cylinder- or barrel-cam, view X, is cylindrical in shape and has a closed groove machined into its outer surface. These cams are also designed with an open groove, view Y, for directing the motion of a spring-loaded follower by edge contact. The plate- or peripheral-cam, view Z, is provided with an irregular contour on its outer edge. A spring-loaded follower is also used to contact this surface.

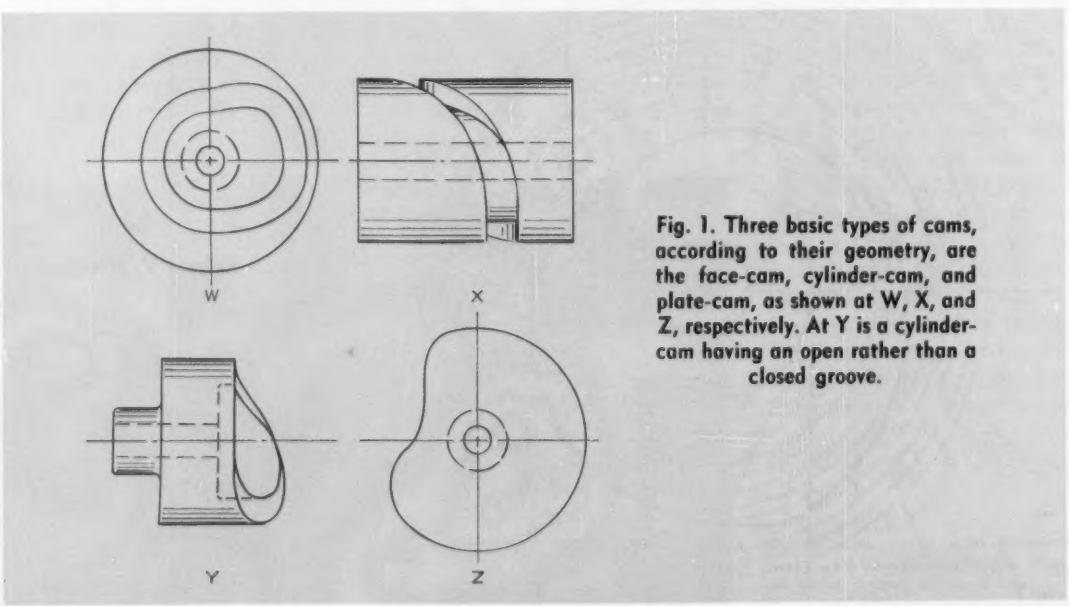


Fig. 1. Three basic types of cams, according to their geometry, are the face-cam, cylinder-cam, and plate-cam, as shown at W, X, and Z, respectively. At Y is a cylinder-cam having an open rather than a closed groove.

Each of the illustrated cam types can be designed to provide a variety of mechanical movements. The classes of motion that are most common in machine and instrument design are harmonic, uniform, and uniformly accelerated or retarded.

Harmonic-Motion Cams

A cam developed from a harmonic curve is preferred for imparting motion to a mechanism. An eccentric or crank produces a true harmonic motion that causes a follower to be accelerated from rest to maximum velocity, then back to rest, with a minimum of shock. The magnitude of the shock occurring in a cam system is primarily dependent on the initial acceleration of the mass of the follower mechanism and is reflected through each component responsive to the cam curve. Greatest shock occurs at the contact surfaces of the cam and the follower, diminishing through each successive component benefiting by material elasticity.

A simplified development of a harmonic rise that is to be effective throughout a 60-degree rotation *A* of the cam is illustrated in Fig. 2. A semicircle having a diameter equal to the total cam rise *R* is drawn tangent to the cam base circle. Both the semicircle and angle *A* are divided into twelve equal parts for constructing the cam curve.

At each division point along the arc of the semicircle, lines are constructed perpendicular to *OB* and then extended in an arc that is concentric with the axis of the cam. At the related intersections of these arcs and the dividing lines of angle *A*, the harmonic curve is constructed. The number of divisions used provides sufficient intersections to permit the plotting of a continuous curve. The radius of the contact edge of follower *F* must be small to capture the true harmonic motion. A slide follower of this type is recommended only for slow movements and intermittent operation.

At X in Fig. 3 can be seen the construction layout for a cam having the same operational requirements as the unit described. The only difference is that a roller follower is used. The method of construction is almost the same, the exception being that the harmonic curve is now the roller pitch line. Curvature of the cam is generated by a cutter of the same diameter as the follower roller, the center line of which is directed in a harmonic path simulating the predetermined movement of the roller. The curve on which the roller will ride (which is the actual curve generated by the cutter) will not, however, follow a true harmonic path.

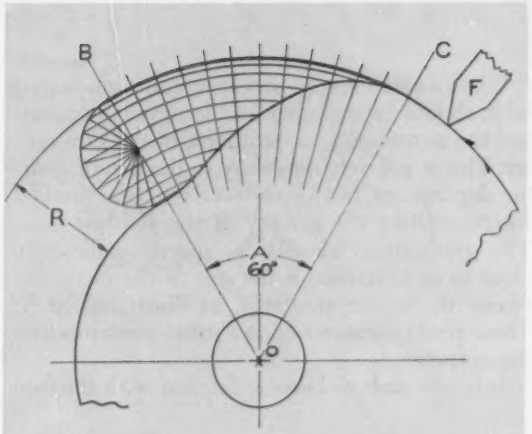
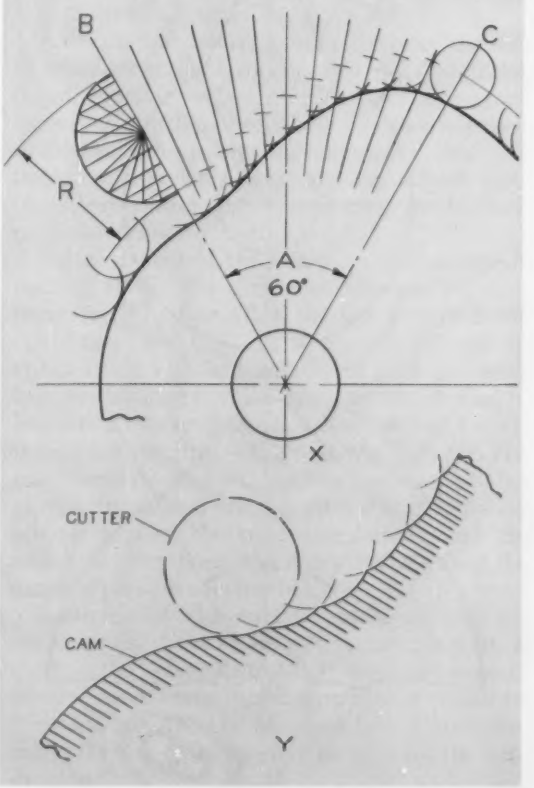


Fig. 2. Development of a harmonic curve on the periphery of a plate-cam. A rise (R) of reciprocating type follower (F) must be accomplished between points (B) and (C) which represent a 60-degree rotation of the cam.

Fig. 3. Layout of a cam, view X, for imparting the same motion as did the cam in Fig. 2. The difference is that a roller type follower is to be used. The diameter of the roller must be the same as the diameter of the cutter shown profiling the cam in view Y.



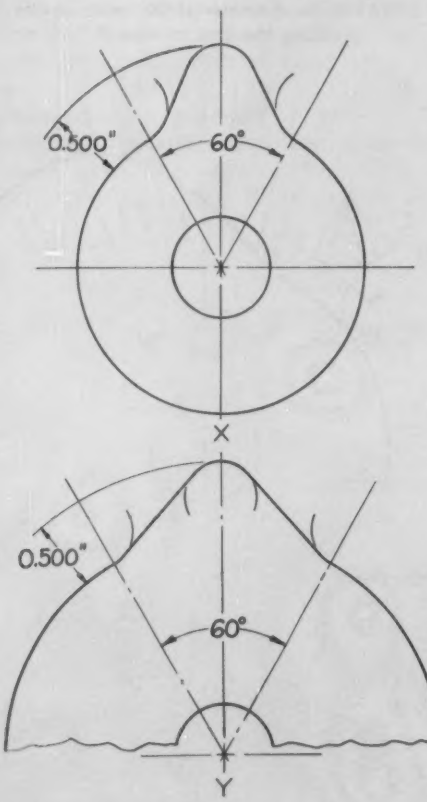
When a cam must be precision cut, a graduated table should be included on the drawing to control the movements, or positions, of the cam cutter. This is not only necessary to the manufacturing department, but also offers a practical method for controlling the quality of the finished cam. The graduations should be spaced sufficiently close so as to minimize the size of the peaks between the cutter positions, as illustrated at Y. These peaks are removed in a subsequent machining operation.

It is advisable to become familiar with the cam manufacturing facilities prior to completion of the design. Many manufacturers stock cam masters for both harmonic and uniform curves. When a master is available that meets the requirements of the cam in question, the graduated table need not appear on the drawing. The notation "Harmonic Rise" in conjunction with the total working angle usually will prove to be sufficient information for the manufacturer.

Unfortunately, the movement requirements of the follower mechanism frequently restrict the linear cam rise and the angular displacement of the camshaft. These restrictions, however, do not close the door to the creative designer who takes advantage of available space and designs a cam that will operate satisfactorily on as large a radius as proves to be practical.

To illustrate, a plate-cam is required to displace its follower 0.500 inch within a 60-degree rotation of the camshaft. Although space is available to accommodate a peak cam radius in excess of 2 inches, a 1 1/2-inch peak radius would seem to be sufficient. This results in the steep cam curve shown at X, Fig. 4, which will render the mechanism inoperative. By enlarging the peak radius to 2 inches, still respecting the basic movement requirements, a curve that is more favorable for a smoothly operating follower is developed, as can be seen at Y. The initial acceleration or climb of the follower is now more gradual and the pressure angle between the cam lobe and the follower has been lessened, thereby reducing follower side thrusts.

Fig. 4. The sides of the cam lobe in view X are too steep to permit the follower to operate. By increasing the cam diameter, still maintaining desired movement characteristics, the rate of rise is lessened, as illustrated in view Y.



Whatever the advantages obtained by increasing the operating radius of a cam, other conditions less favorable to a theoretically perfect design are presented. As the cam diameter is increased, the power drive requirements are also increased. A further result is a higher peripheral speed, which causes increased wear on the rapidly rotating follower roller. The advantages of the larger cam, however, usually overshadow the disadvantages.

The accepted method for designing both face- and cylinder-cams is fundamentally the same as that for designing plate-cams. Differences in the geometry of a cylinder-cam, such as the one illustrated at X, Fig. 5, necessitate a modification of design concept. The track on a cylinder-cam, unlike that on a plate- or face-cam, is laid out from linear rather than radial measurements. Design considerations become basic when the periphery of the cylinder-cam is unfolded for linear development, as shown at Y. If a graduated table is required, it should contain a linear tabulation of the cutter positions. Each cam presents

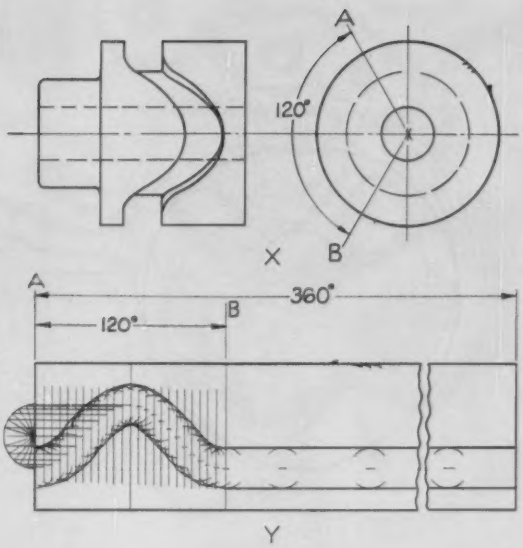


Fig. 5. When designing cylinder-cams, the track is constructed from linear measurements instead of radial measurements. The periphery of the cam is unfolded, as can be seen in view Y.

new requirements that have to be taken into consideration. When designing a cam, it is well to bear in mind that a drawing is required to permanently record the design data and to provide sufficient information to permit complete manufacture of the part.

Designing Cams to Impart Uniform Motion

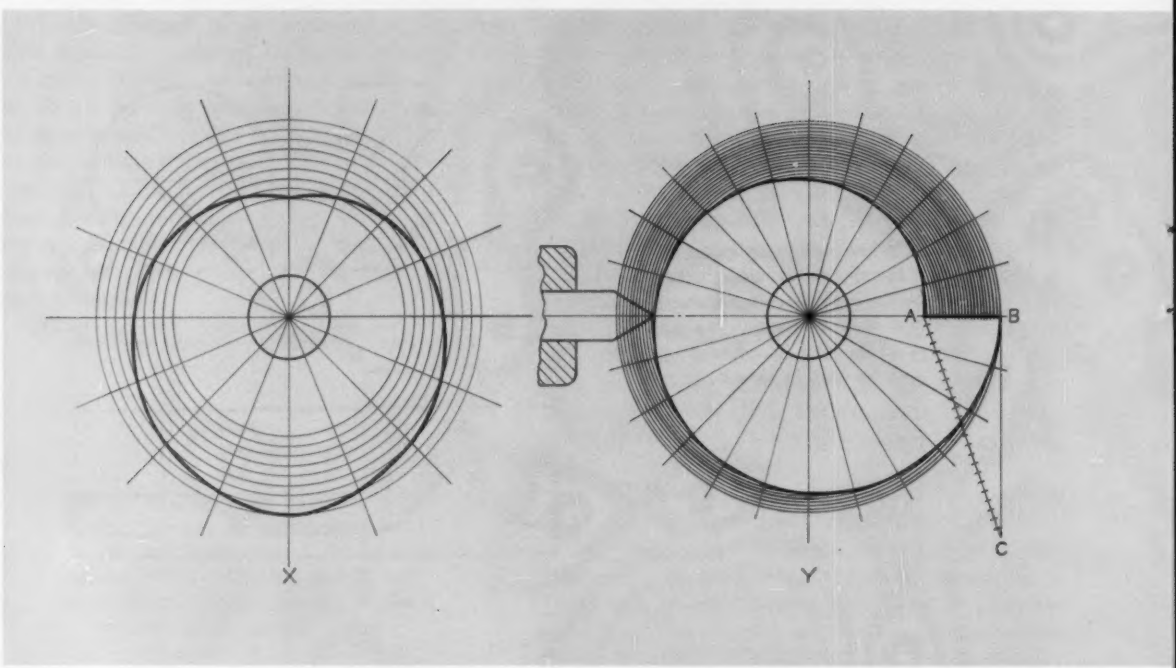
Uniform-motion cams are used in systems that require a continuous unchanging rate of movement per unit of camshaft rotation. They are widely used in fire-control and computing systems which necessitate measured accuracy and relatively slow movement. These cams are not recommended for applications where uniform motions are to be imparted to high-speed shafts, although they will function satisfactorily in many installations. A repeated shock condition is characteristic of this type of cam and would shorten the life and decrease the accuracy of the mechanism or machine in which it was being used.

Heart-shaped construction typifies the uniform-motion cam, as illustrated at X in Fig. 6. It provides a uniform rate of incline during a rotation of 180 degrees, followed by a uniform rate of decline. To construct this cam, the base and peak circles are first drawn and then divided into eight equal spaces, all concentric to the center of the cam. These concentric circles are then divided radially into sixteen equal sectors, eight for the rise and eight for the return. At the intersection of each pair of related division lines, a small dot is placed to serve as a guide point during construction of the cam curve.

A design that assures greater accuracy per unit of camshaft rotation can be seen at Y. Requiring a bidirectional control, this design offers a uniform rate of incline throughout almost a full cycle of rotation. This type of movement is desirable in numerous automatic sensing units as well as in simplified control devices and other mechanisms requiring accurate functioning.

Establishment of the minimum and maximum operating radii, the difference between which is represented by line *AB*, is the first step in developing this cam. Line *AC* is constructed and divided into a sufficient number of parts (twenty-four in this case) which are then transferred to line *AB*. From each division line on *AB*, a circle is drawn concentric to the center of the cam. The cam face is divided radially into the same number of equal parts as is line *AB*. At the corresponding intersections of the concentric circles and the radial dividing lines, the curve representing the cam periphery is constructed.

Accuracy of the cam depends on the accuracy of the divisions. For this reason, line *AC* is used in the construction. It is more accurate to divide line *AC* into equal parts than it would be to divide line *AB*. The length of line *AC* is a random selection to adequately provide for the subdivisions.



Uniformly Accelerated- and Retarded-Motion Cams

A uniformly accelerated- and retarded-motion cam, sometimes referred to as a gravity cam, provides a movement that is gradually accelerated and decelerated in a fixed-motion pattern. This principle is based on the gravitational attraction of the earth on a falling body, causing the body to accelerate at the rate of 32 feet per second per second. The ratio of this acceleration is 16-48-80-112, etc., which is a basic ratio of 1-3-5-7, etc. By applying this principle of gravitational attraction to cam design, the follower will be caused to decelerate in the same pattern. Combining acceleration with deceleration, the cam curve follows a pattern of 1-3-5-7-5-3-1.

Designing a uniformly accelerated- and retarded-motion cam such as the one seen in Fig. 7 is similar to the procedure followed in designing the uniform-motion cam. Line *AB* is drawn to define the minimum and maximum pitch radius of the follower roller. Line *AC* is constructed and divided into a selected number of divisions that are uniformly increased in the proportion of 1-3-5-7-9-11-13-15. The divisions on line *AC* are transferred to line *AB*, and circles concentric to the center of the cam are drawn to pass through each of these points.

The cam face is divided into equal parts corresponding to twice the number of divisions of line *AB*. At the related intersections of the cam-face radii and the concentric circles, an arc with a radius equal to that of the roller is drawn. The physical outline of the cam is determined by the positions of the roller radii, which are connected to form a continuous curve. Once again, when extreme accuracy is required, a graduated table indicating the movement and the various positions of the cam cutter should be included with the layout.

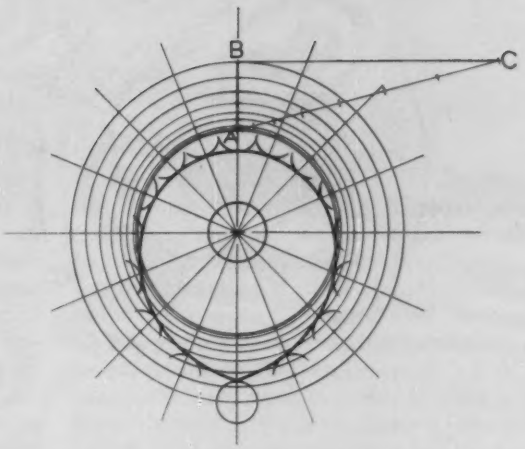
Rarely is an application found for a uniformly accelerated and retarded motion that is a true gravitational simulation. The primary purpose of the cam is to offer another systematic method of accomplishing a mechanical movement for a system in need of a gradual rise and fall. There are cam applications that require a regulated increase in movement per unit of rotation such as 1-4-7-10-13-16, etc. This, too, would take the form of a uniformly accelerated curve, and the cam would be designed fundamentally the same as the one shown in Fig. 7.

Designing Cams to Impart Irregular Motion

An irregular or random-shaped cam imparts a combination of movements to the follower during each cycle of the comparatively slow-moving

Fig. 6. (Left) Uniform-motion cam, view X, imparts a uniform rate of ascent to the follower during one-half revolution and a uniform rate of descent during the remaining one-half revolution. The cam shown in view Y provides a uniform rate of incline during a complete revolution.

Fig. 7. (Right) Construction layout for uniformly accelerated- and retarded-motion cam having a rise and fall rate in the proportion of 1-3-5-7, etc. The movement principle is based on the gravitational attraction of the earth on a falling body.



cam. It is sometimes designed to provide a combination of harmonic and uniform movements as shown at X in Fig. 8.

Rotating in a counterclockwise direction, the illustrated cam performs a variety of functions. The follower is required to rise 0.500 inch during a 50-degree rotation of the cam. Because of the relatively steep incline, a harmonic motion is selected. A dwell period of 15 degrees between points *B* and *C* requires no construction lines other than the radius of the roller.

The follower then is required to drop a distance of 0.200 inch between points *C* and *D*. This 40-degree arc is divided into five equal parts and five concentric divisions, each concentric division being 0.040-inch wide. At the intersection of each arc and its respective radial division line, the radius of the follower is drawn. This phase is followed by a dwell period of 40 degrees between points *D* and *E*. No construction lines are required.

Between points *E* and *F*, the follower is required to fall an additional 0.250 inch during 50 degrees of cam rotation. Arc *EF* is divided into five equal sections and five concentric divisions. The concentric bands are 0.050 inch wide. At the intersection of the related arcs and radial division lines, the follower radius is drawn.

A dwell period of 45 degrees is provided between points *F* and *G*, followed by a rise of 0.200 inch during 45 degrees of cam rotation. Arc *GH* is divided radially into five equal parts and also into the same number of concentric divisions of 0.040 inch each. The follower radius is drawn at the respective line intersections.

The final fall between points *H* and *A* is 0.250 inch during a 75-degree rotation of the cam. Arc *HA* is divided into six equally spaced radial sections and six equally spaced concentric arcs. If accuracy is respected throughout the design of this cam, the end of the pitch line will be coincident with the start. At the intersections of the arcs and the respective radial division lines, the radius of the roller is drawn, thus completing the entire cam contour.

At Y in Fig. 8 can be seen a graphical analysis of the pitch line of the cam illustrated at X. This composite picture is of value for future reference as well as being instructive to the manufacturing department.

The methods that have been presented for designing various cam characteristics will provide the true intended movements only if the follower rises and falls in a reciprocating straight-line movement. If, however, the follower is part of, or attached to, a lever, it will oscillate in a curved path and will not faithfully reproduce the motion intended. This can be clearly seen by referring to Fig. 9.

At X in the illustration are two rollers, one be-

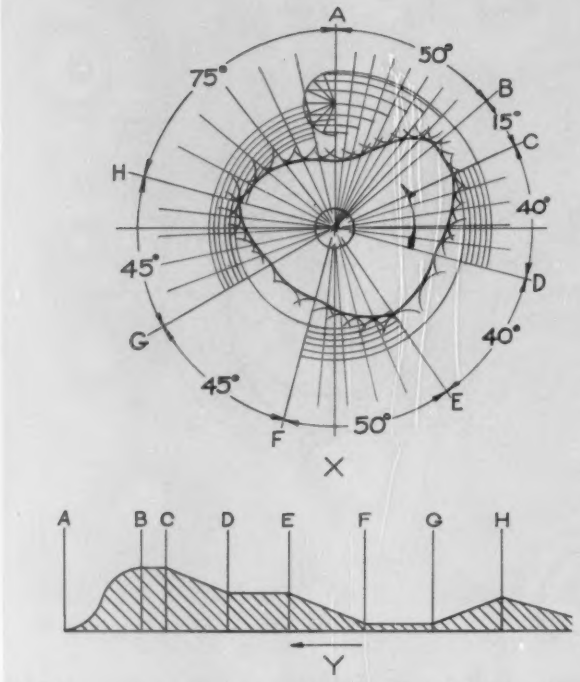


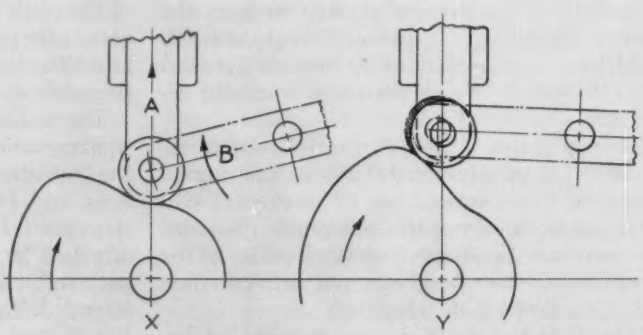
Fig. 8. Random-shaped cam designed to provide a combination of harmonic and uniform movements, view X. Three dwell periods are also included. A graphical analysis of the cam pitch line is illustrated in view Y.

ing attached to reciprocating slide *A* and the other to lever *B*. Both rollers occupy the same position at the approach of the cam incline. As the rollers ascend the incline there is a change in their relative positions as shown by the shaded area in view Y. The alteration in position is due to the variation between the straight-line movement of *A* and the arcuate movement of *B*.

Lever *B*, therefore, does not follow the movement intended for reciprocating slide *A*. For many applications this difference is not objectionable. In more exacting applications, however, where a measured displacement of the follower per unit rotation of the cam is to be respected, this variation must be accounted for.

Other facets of cam design, such as oscillating followers for plate- and cylinder-cams, sliding and rolling types of cam followers, and cam pressure angles, will be brought out in the concluding installment of this article.

Fig. 9. Cams that have been designed for use with a reciprocating follower will not produce the same movement when employed with an oscillating follower. The shaded area at Y shows the difference in movement imparted to reciprocating follower (A) and oscillating follower (B).



How Small Presses Assemble Automotive Heater Controls

By Raymond F. Gamundi, Plant Superintendent
Eaton Mfg. Co., Cleveland, Ohio

THOUSANDS of heating units are assembled daily at the automotive heater division of the Eaton Mfg. Co., Cleveland, Ohio. An uninterrupted production flow is maintained by a bank of four 6-ton capacity Denison Multipress units. These four hydraulic presses are equipped with rotary index-tables and are in constant operation on the many parts that make up the panel and heater controls for the 1956 Ford automobile.

Maximum index-table cycle rate and minimum ram tonnage are made available by a cylinder head relief valve installed on each press. Inching and hold-down controls are provided for use when setting up the machines.

The first press operation consists of building up air-regulator lever sub-assemblies for the heater controls. Two lever staking-pins are fed to the six-station index-table by means of pin conveyors leading from individual bins as can be seen at the right in Fig. 1. From a continuously revolving hopper, supported above the press head, rollers are fed through the vertical chutes illustrated and are positioned over the pins. This positioning is assisted by a pneumatic device that is interconnected to the movement of the ram.

After the table has indexed one station, an operator places a lever stamping over the pins. The table indexes once again to bring the parts under the press ram. As the ram descends, a hold-down tool contacts the work to steady it while a punch stakes the pins to the lever under a pressure of 2 tons. A jet of air ejects the sub-assembly from the index-table, causing it to fall onto a slide leading to a storage bin. Between 4500 and 5000 of these parts are assembled each day.

The next step in assembling the heater control is to attach the temperature-control lever to the control bracket. Two presses run continuously at this operation, each machine being serviced by two operators. A pivot-pin and a control bracket are positioned at one station of a rotary index-table by the first operator, Fig. 2. The second op-

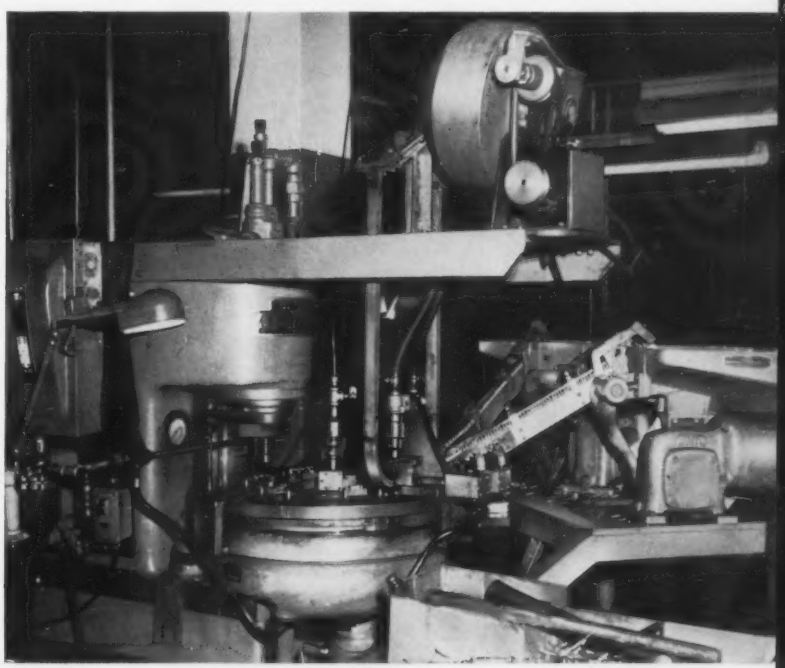


Fig. 1. Staking rollers and pins to a lever stamping to form an air-regulator sub-assembly. The pins are fed from individual bins (right) while the rollers are fed from a single rotating hopper (top) to an indexing type of press table.

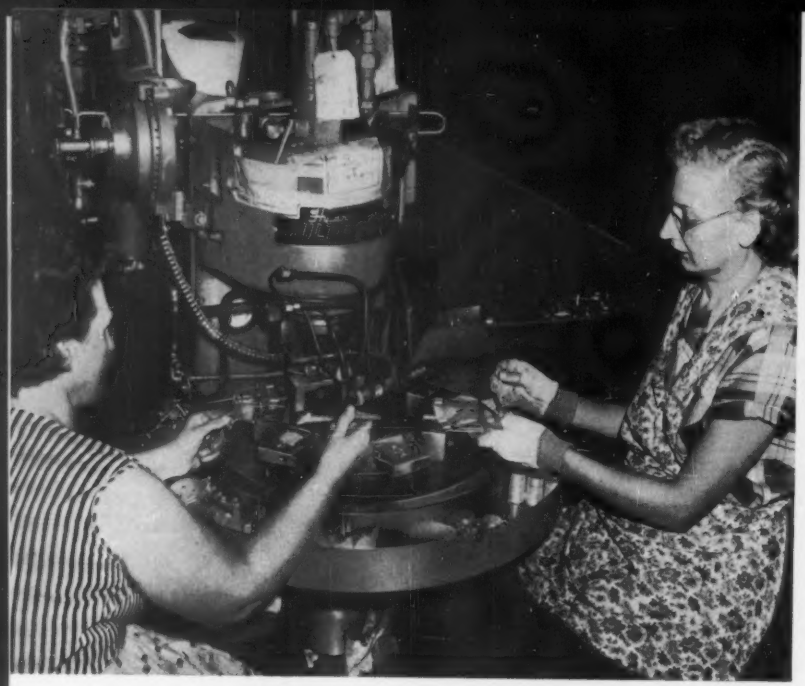
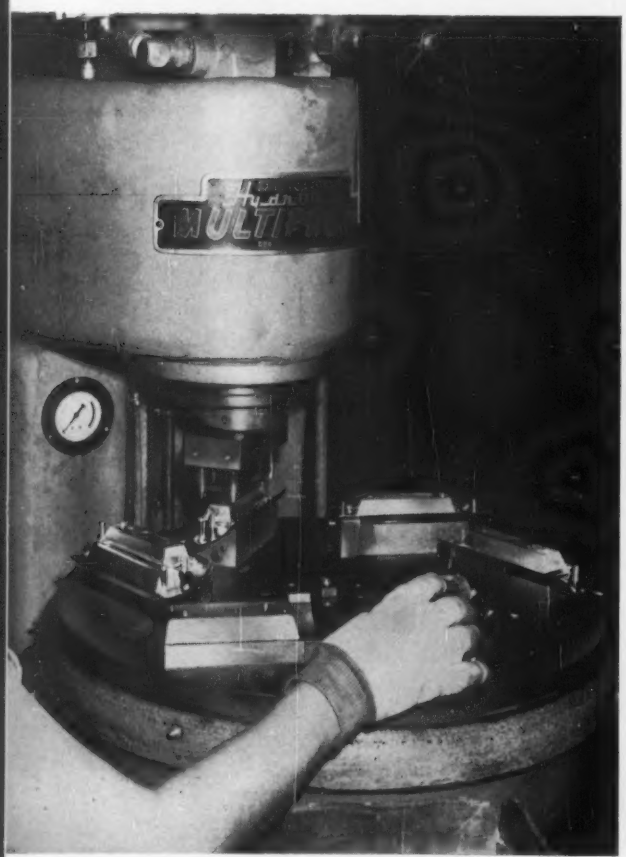


Fig. 2. Assembling temperature-control levers to control brackets on a 6-ton capacity hydraulic press. The revolving table feeds parts under the press ram where they are riveted together and then air-ejected onto a conveyor.

Fig. 3. Final assembly of the control panel for an automobile heater. The rear section is placed over the front section, which has four integral pins. After being positioned beneath the press ram, the pins are headed.



erator adds the temperature-control lever and a Tinnerman holding clip, and also applies a coating of Lubriplate to the bracket. An attachment on the second press automatically air-sprays the lubricant on the part under a pressure of 35 pounds per square inch.

Movement of the index-table brings the parts beneath the press ram where they are riveted together. From a hopper mounted on the press head, the rivets travel along a chute to a position under the ram. After the press stroke is completed, an air nozzle ejects the parts onto a conveyor belt that carries them to the next location. These two presses turn out 7500 units per day.

To assemble the back section of the control panel to the front dash section, a staking fixture is mounted on the ram of the fourth Multi-press. As a six-station index-table revolves, the operator places the two parts to be staked on one of six holding fixtures, Fig. 3. The staking-pins are integral with the front dash section of the control panel. The back section is placed over the front section with the pins serving as guides. Each movement of the press carries one unit under the ram which descends and locks the two sections together.

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Stainless-Steel Production Breaks All Records

Production of stainless and heat-resisting steels in 1955 reached an all-time high according to the American Iron and Steel Institute. Production for the year was 1,191,177 net ingot tons, compared to 852,021 net tons for 1954.

INGENIOUS *Mechanisms*

Mechanisms selected by experienced machine designers as typical examples applicable in the construction of automatic machines and other devices

Ball Bearing Serves as Planetary Reduction Gear

By ALEXANDER R. GILAT, Haifa, Israel

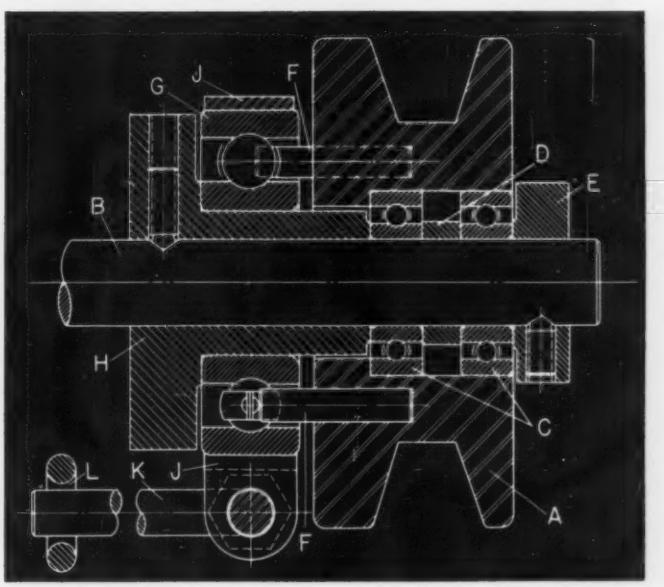
A light-duty mechanism, driven by a 1/10-H.P. motor, was found to be running too fast to permit proper functioning. Since no space was available within the mechanism housing to permit the use of a larger driven pulley, another means of speed reduction was sought. This took the form of a conventional single-row, heavy-series type ball bearing, which was caused to function as a reducing planetary gear unit.

As shown in the illustration, driving pulley *A* is allowed free rotation on motor shaft *B* by two ball bearings *C*. A spacer *D* is placed between the bearings, and collar *E* retains them. Steel pins *F* are pressed into one side of the driving pulley, their free ends projecting into the rivet space between the cage recesses that contain the balls of the heavy-series type ball bearing *G*.

The inner race of bearing *G* is a press fit on sleeve *H*, which, in turn, is secured to motor shaft *B*. The outer race of the bearing is held stationary by a split band *J*. Pressure is applied to the split band by tightening L-shaped bolt *K*, the end of which passes through eye-bolt *L*. The eye-bolt is fastened to the frame of the motor.

When the motor shaft rotates, sleeve *H* and the inner race of ball bearing *G* move in unison with it. This movement drives the balls and the cage of the bearing, causing the balls to roll along the fixed outer race. Driving pulley *A* is thus rotated at a reduced speed through the engagement of pins *F* with the moving cage of bearing *G*. The slight axial load applied to the balls by pins *F* tends to increase the power-transmitting capacity of the drive. In practice, no noticeable slip was encountered, even during the instantaneous application of heavy loads to the driving pulley *A*.

Rotational speed of the inner race of bearing *G* (also of the motor shaft) is $\left(1 + \frac{D_o}{D_i} \right)$ times the rotational speed of the cage, where D_o is the diameter of the inner-race ball track and D_i is the diameter of the outer-race ball track. With the particular bearing used in the illustrated setup, the speed reduction between the motor shaft and the driving pulley was approximately 2.5 to 1.



This drive mechanism makes use of a ball bearing (G) to serve in the capacity of a reducing planetary gear unit.

Driving Mechanism Prevents Reverse Movement of Driven Shaft

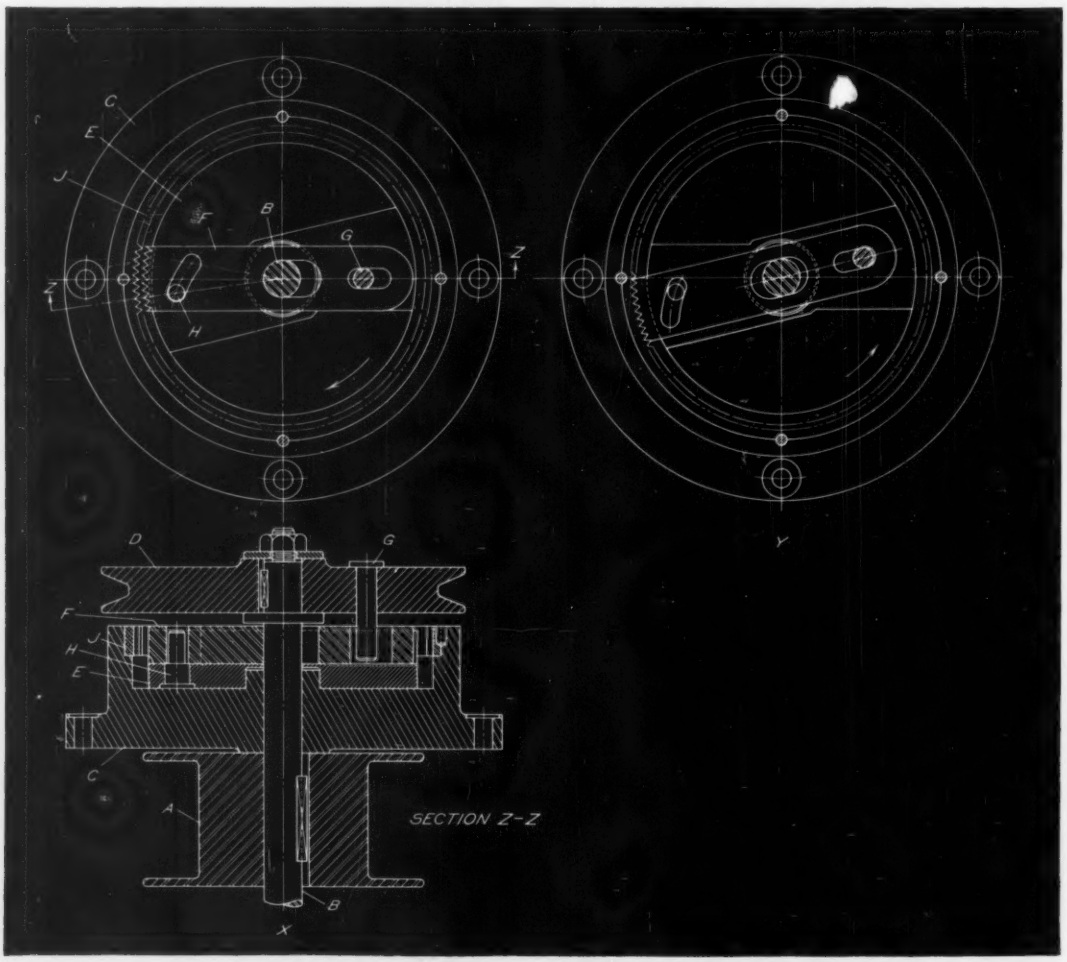
By William H. Morson, Birkdale, England

Feed arrangements for a special wire-forming machine required intermittent, unidirectional rotation of the feed-drive shaft. Of necessity, any shaft reversal during dwell periods in the feed cycle had to be avoided. To meet these demands, the illustrated drive mechanism was developed.

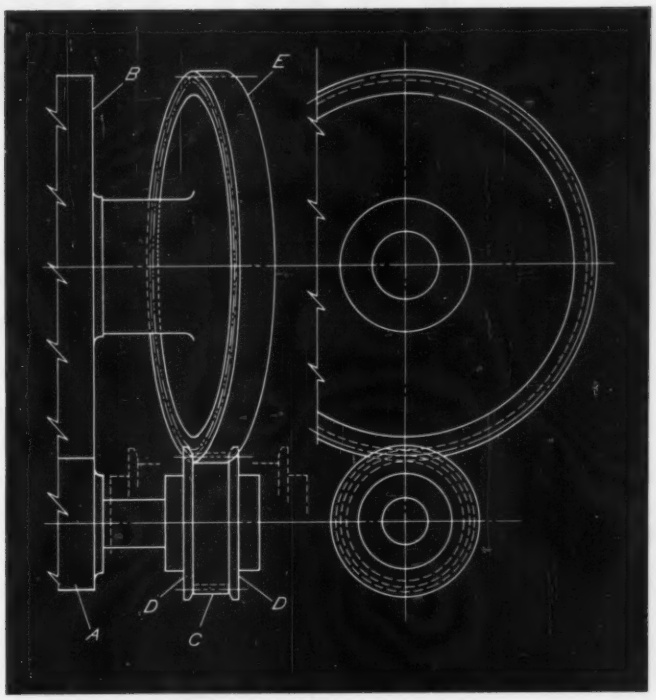
Wire feed spool *A* is keyed to driven shaft *B*, as shown at X (section Z-Z). The shaft runs freely within the stationary, circular bearing bracket *C*, the lower end of which is flanged and drilled for mounting purposes. A clockwise rotation (indicated by the arrow) is imparted to the spool by pulley *D*, keyed to the shouldered end of the driven shaft. A nut and washer retain the pulley in position.

A counterbored recess is machined in the upper surface of bracket *C*. Cast-iron circular plate *E* is mounted at the base of this recess, a counterbore in the bottom face of the plate being a running fit over an internal hub on the bracket. The through hole in plate *E* is bored to be a running fit with driven shaft *B*.

A deep slot is cut diametrically across the upper surface of plate *E* to receive sliding bar *F*. Two diagonally opposed sides of this slot are relieved for clearance purposes. A short elongated slot, located approximately in the center of the sliding bar, is a slip fit over the driven shaft. Headed steel pin *G* is driven through a hole in the web of the pulley and projects into an elongated slot in the



Drive mechanism arrests any reverse movement of driven shaft (B).



Shrouds (D) constrain gear (C) to the helicoidal path of gear (E), causing roll (A) to vibrate axially as well as rotate.

right-hand end of sliding bar *F*. At the opposite end of the bar is a short arcuate slot. Engaging this slot is the projecting portion of shoulder-pin *H*. This pin is pressed into a hole that has been drilled in circular plate *E*.

Cut across the left-hand end of the sliding bar is a series of hardened, fine-pitch vee serrations. A case-hardened steel ring *J*, having internal vee serrations matching those of the sliding bar, is pressed and pinned into the largest diameter step of the recess in bearing bracket *C*.

The diagrams at X in the illustration show the relative positions assumed by the various components while shaft *B* is being driven in its normal (clockwise) direction of rotation. Pulley *D*, sliding bar *F*, and circular plate *E* rotate in unison, being connected by pins *G* and *H*. The curved slot bearing against pin *H* serves to hold the sliding bar to the right, thus allowing free movement of all the components.

When pulley *D* is at rest, any movement of spool *A* in the reverse direction will be instantly arrested. Such a movement will be transmitted to the pulley and thus to pin *G*. The pin, in turn, will cause bar *F* to rotate counter-clockwise for a short distance. As this occurs, and the left-hand slot is caused to slide in contact with pin *H*, the bar will be forced to the left until it engages the vee serrations on ring *J*. In this way, the drive mechanism is positively locked, as shown at Y, and will remain so until normal rotation is resumed.

Vibrating Roll Drive for Printing Press Fountains

By H. B. SCHELL, Brooklyn, N. Y.

In the ink-distributing fountain of a printing press, certain rolls have to vibrate axially as well as rotate. The device illustrated shows a simple drive that produces both of these movements in a small-diameter roll *A*. This roll is in contact with a large-diameter roll *B* which rotates but does not itself vibrate. Keyed to the end of each roll shaft is a spur gear. Both gears have pitch diameters that are equal to the outside diameters of the respective rolls to which they are attached.

On each side of the smaller gear *C* is a shroud *D*. These shrouds overlap the rim of the larger gear *E*. The face of this gear is in a helicoidal path —one-half of its periphery follows a right-hand helix, and the other half, a left-hand helix. In operation, gear *E* drives gear *C*, and the shrouds constrain the smaller gear to follow the face of the larger gear. The result is to produce an axial movement of the roll shaft of the smaller gear equal to the throw of the larger gear, as indicated by the dotted lines.

Gear *E* is driven by other gearing, not shown in the illustration. The pinion driving this gear has a face that is wide enough to cover both extremes of the throw.

MACHINERY'S PROBLEM CLINIC

Mathematical problems in shop work and tool design submitted by readers of MACHINERY

Edited by HENRY H. RYFFEL

Simplified Change-Gear Calculations

By RAY M. PAGE

Most systematic methods for determining a set of four change-gears to produce a specified gear ratio require considerable calculation and pencil work. This work can be eliminated in most cases by the use of a calculating machine in conjunction with a simple trial-and-error procedure based on the usual formula expressing the relation between a gear ratio and the numbers of teeth in the gears:

$$\text{Gear ratio } R = \frac{\text{Driving gear} \times \text{driving gear}}{\text{Driven gear} \times \text{driven gear}}$$

or

$$\text{Gear ratio } R \times \text{product of driven gears} = \text{product of driving gears}$$

Method:

1. Set the desired ratio R in the keyboard of the calculating machine.
2. By repeated addition of this ratio R (the equivalent of multiplication) find a multiplier M such that the product $M \times R$ is a whole number I, or nearly so.
3. Convert the fraction $\frac{I}{M}$ to the desired change-gears

As a simple example of how the method is applied, consider the ratio 0.750. Here 0.750 is set on the keyboard, and then by repeated addition the fraction 3/4 is determined:

R	M	I	
0.750	× 1	= 0.750	
	× 2	= 1.500	
	× 3	= 2.250	
	× 4	= 3.000	←whole number

$$\text{Therefore } 0.750 = \frac{I}{M} = \frac{3}{4}$$

This fraction is next converted to provide the driving and driven gears, an operation familiar to those making gear-ratio calculations:

$$0.750 = \frac{3}{4} = \frac{3 \times 800}{4 \times 800} = \frac{2400}{3200} = \frac{40 \times 60}{50 \times 64}$$

As a second example, gears for a ratio of 0.750176 will be determined:

0.750176	× 1400	= 1050.246400	
	× 1401	= 1050.996576	
	× 1402	= 1051.746752	
	× 1403	= 1052.496928	
	× etc.	=	
	× 1413	= 1059.998688	
	× etc.	=	
	× 1421	= 1066.000096	←nearly whole number

The ratio 0.750176 was multiplied first by 1400, a number selected at random, and repeated addition applied until 1066.000096 was obtained. It is evident that this is very close to 1066, so that 0.750176 is very nearly represented by the fraction $\frac{1066}{1421}$. As a matter of fact, $\frac{1066}{1421}$ is within 0.0000001 of being equal to 0.750176. It is interesting to note that if such a high degree of accuracy were not required, the fraction $\frac{1060}{1413}$ might have been considered: $\frac{1060}{1413} = 0.7501769$, which is within 0.0000009 of 0.750176. However, the factors of the denominator of this fraction, 1413, are 9 and 157, and since 157 is greater than the largest generally available change-gear (120), this fraction could not be used.

The factors of the fraction $\frac{1066}{1421}$ are $\frac{26 \times 41}{29 \times 49}$

Each of these factors is within the standard range of change-gears (20 to 120).

TOOL ENGINEERING *Ideas*

Tools and fixtures of unusual design and time- and labor-saving methods that have been found useful by men engaged in tool design and shop work

Shearing Tool for Thin-Wall Tubing

By FEDERICO STRASSER, Santiago, Chile

Tubing having comparatively thick walls can be sheared on a press by the use of very simple dies. However, when the ratio of the wall thickness to the diameter becomes too small, the tubing lacks sufficient rigidity to resist the shearing stresses without collapsing in the die. As a result, it is necessary to provide some means of support for the work during the cutting stroke.

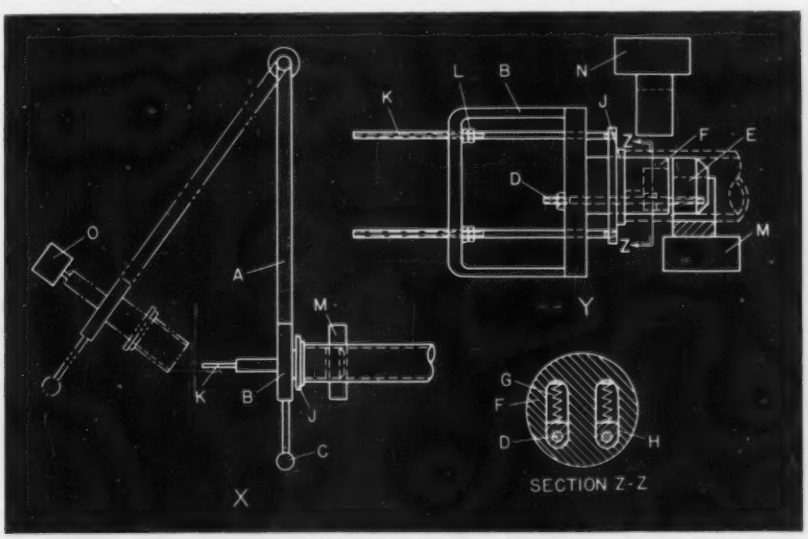
A tool that was designed to furnish this support, and also to provide a means of ejecting the sheared length of tubing, is illustrated. Essentially, the device is a conventional tube-shearing die set that is used in conjunction with swinging arm *A*, as shown in the plan view at X. The arm carries a frame *B* and is actuated by handle *C*.

Attached to the frame by two long studs *D*, as shown at Y, is a mandrel assembly that is a sliding fit within the tubing to be sheared. The leading portion *E* of the mandrel is stationary. Section *F* of the mandrel is a movable member. It is held in alignment with the stationary member by springs *G* (section Z-Z). The springs fit into slots machined in member *F* and bear against both the movable mandrel and slides *H*, the slides being held stationary by studs *D*.

Stop-collar *J* is situated adjacent to the movable mandrel and is fastened to ejector-pins *K*. The ejector-pins pass through both sides of the frame and extend out to the left. Stop-nuts *L* serve to locate collar *J* at its extreme left-hand position.

To operate this tool, swinging arm *A* is held against stationary die member *M* by a quick-acting toggle clamp (not shown) or some other suitable means. The tube to be cut is fed into die member *M*, over the mandrel assembly, and up against stop-collar *J*. When the press is actuated, punch member *N* descends, contacting the portion of the tube that is supported by movable mandrel *F*. As the punch continues to descend, the movable mandrel is forced in a downward direction for a short distance and the tube is sheared. This tends to provide a shearing action completely around the periphery of the work.

After the cut is completed, and while the punch retracts, the movable mandrel is returned



Shearing device for use on a press provides internal support when cutting thin-wall tubing.

to its original position by springs *G*. The tool is then unclamped and swung back until ejector-pins *K* strike fixed ejector-block *O*. This forces stop-collar *J* to the right, thus dismounting the sheared work-piece from the mandrel assembly. The stop-collar will be returned to its original position by the next length of tubing that is fed into the unit. To shear the tubing to different lengths, the mandrel assembly must be replaced and the stop-collar adjusted accordingly.

Fixture for Use in Grinding Angles and Rounded Corners

By J. Randolph Lucas, Richmond, Va.

Various combinations of straight and curved surfaces can be finish-ground by using the general-purpose fixture shown in the accompanying illustrations. Rapid set-up and simple operation are two desirable features of this device.

A work-piece that requires a rounded corner having a radius of 0.812 inch on each end and angular surfaces of 7 degrees is illustrated in Fig. 1 by the solid lines. The blank from which this part was made is shown by dotted lines. One rounded corner and tapered side are scribed on the face of the blank. The work is then turned over and the same procedure is followed on its opposite end. Locations of the radii should be center-punched. Excess stock is next removed on a band saw to facilitate grinding.

Top plate *A* and bottom plate *B* are attached to rectangular spacers *C* and *D* by cap-screws. These members form the boxlike base of the fixture, as shown at X in Fig. 2. Swivel-table *E* pivots about tapered stud *F*, a nut *G* on the stud permitting the table to be locked in any desired position.

Two table-stops, shown at Y, are used—stop *H* is pressed into slide *J* and stop *K* is pressed into slide *L*. Each slide is located against an edge of top plate *A* by two screws. The screws pass through long slots machined in the slides, thus providing a means of adjustment.

In setting up the fixture, it is placed on a magnetic chuck on the table of a horizontal grinding machine. The back edge of top plate *A* is indicated to bring it parallel to the path of the work-

Fig. 1. Typical work-piece, having tapered ends and rounded corners, that can be ground to shape on the general-purpose fixture illustrated in Fig. 2.

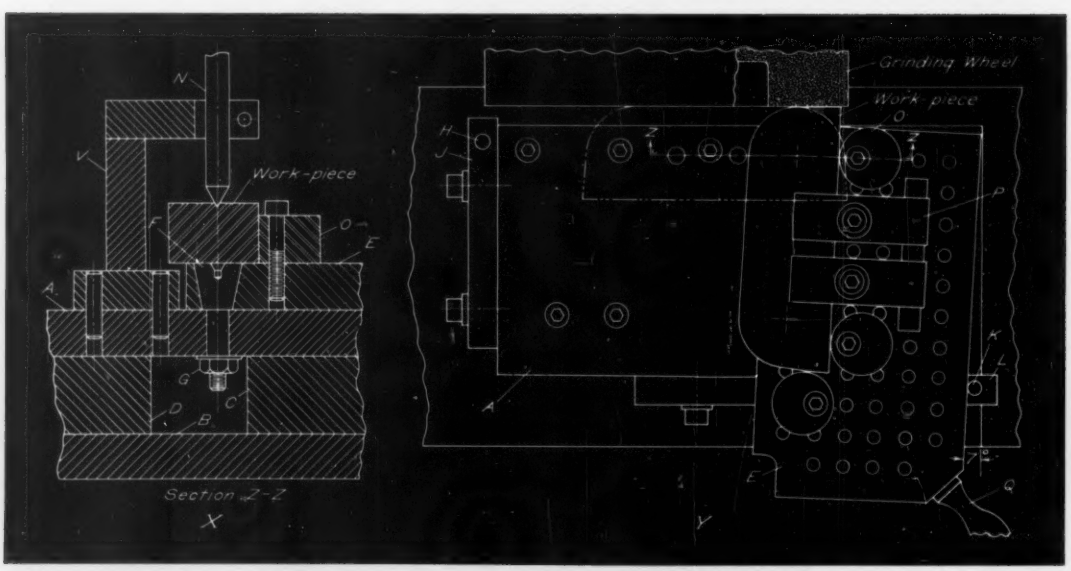


Fig. 2. Fixture which facilitates the grinding of work-pieces having various combinations of straight and curved surfaces. Eccentric washers serve as readily adjustable banking points.

table. The work-piece is positioned on swivel-table *E* by a locating gage *V* which is doweled to top plate *A*, as shown at X. Sliding center *N* should be in direct alignment with the center of tapered stud *F*. The sliding center is used to align the punch mark on the face of the work-piece with the point about which the table will pivot.

Three eccentrically drilled washers *O* bear against the work-piece and serve as banking points. Straps *P* are used to clamp the work to the table. Locating gage *V* is then removed.

A protractor is employed to set table *E* at an angle of 7 degrees, as shown at Y. Table-stop *K* is then set against the side of the swivel-table and slide *L* is locked in place. Table-stop *H*, together with slide *J*, is adjusted so that the forward edge of the swivel-table will be parallel to the face of the abrasive wheel at the end of the grinding stroke.

To grind the 7-degree taper, table *E* is held against stop *K* by means of handle *Q* and locked by nut *G*. The machine table is then fed past the abrasive wheel, and the rounded corner is formed by pivoting the table until it contacts stop *H*.

After these surfaces have been ground on all the work-pieces, they are turned over and the same procedure is followed in grinding the opposite tapered end and rounded corner. Locating gage *V* is used to line up the second punch mark, and the eccentric washer at the end of the part is adjusted accordingly.

Lathe Fixture for Eccentric Turning

By H. J. GERBER, Stillwater, Okla.

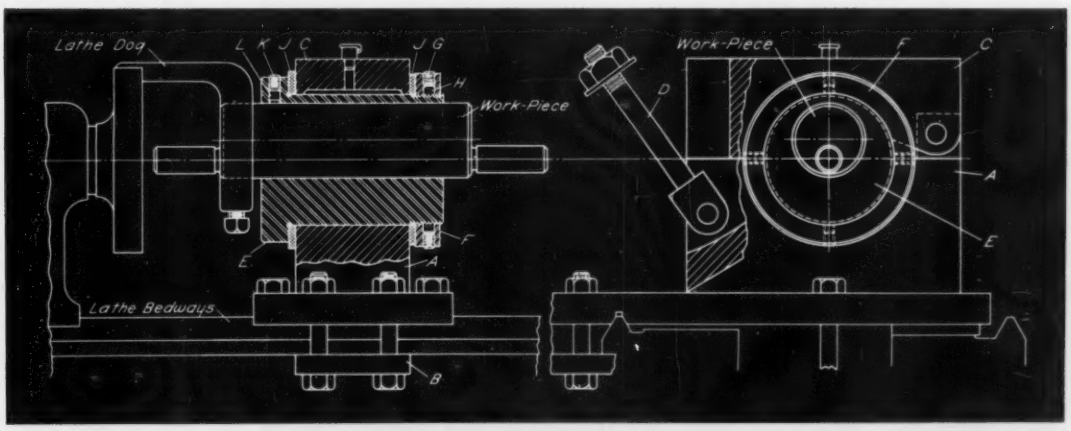
A lathe turning operation was required to form two crankpins on a common center line, one on either end of a short shaft. Due to the small size of these cranks, it was not considered practical to turn them on centers. Also, the large main shaft diameter of the work prohibited the use of an eccentric collet on an engine lathe.

The fixture illustrated was designed to facilitate this turning operation. Body *A* is a weldment consisting of a rectangular block, a baseplate, and a supporting pad. The under side of the baseplate is machined to ride over a V-shaped bedway of the lathe, while the pad rides on a flat bedway. Four bolts and clamping plate *B* lock the fixture to the machine bed.

Cover plate *C* is hinged to the body and may be locked in place by means of latch-bolt *D*. A hole is bored through the body and cover combination to receive flanged bushing *E* with a running fit. Threaded collar *F* engages the right-hand end of the bushing and secures it in place. The collar, in turn, is locked by four set-screws *G* that force brass plugs *H* into contact with the bushing threads. A fiber thrust washer *J* is provided at each end of the body.

To use this fixture, the work-piece is placed within a hole bored through the flanged bushing at the desired offset and locked by four set-screws *K* and four soft plugs *L*. After placing the lathe dog on one end of the shaft, the bushing is inserted in the fixture body and the cover plate is closed and locked. Threaded collar *F* is run up snugly against the adjacent thrust washer and held firmly by set-screws *G*.

The right-hand crankpin may now be turned. When this is completed, the cover plate is unlatched, and the bushing reversed end for end. After reclamping, the second crankpin is turned.



Lathe fixture simplifies turning of in-line crankpins located on both ends of a short shaft.

LATEST DEVELOPMENTS IN *Shop*

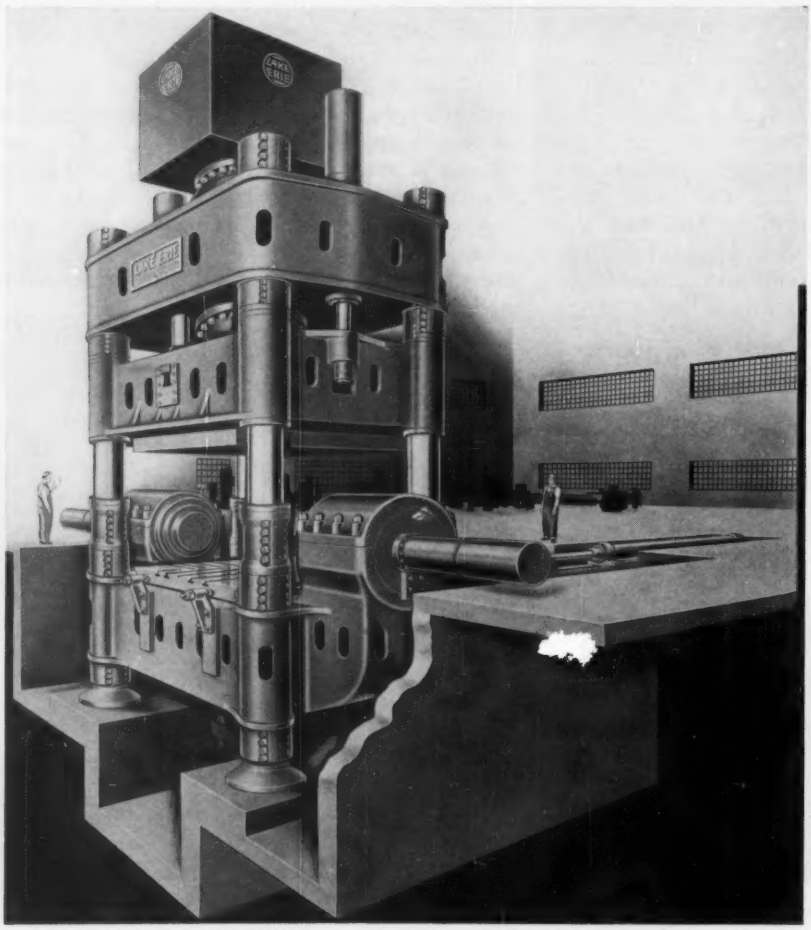
Gigantic Forging Press with Side Rams

A newly designed, 4000-ton forging press of gigantic proportions has been brought out by the Lake Erie Engineering Corporation, Buffalo, N. Y. This press is of the down-stroke, column type design and is operated by an accumulator at a water pressure of 4500 pounds per square inch. The main ram of the press and the opposed side rams will be employed for open forging of heavy aluminum billets.

The size of the press bed between positive stops is 70 inches front to back and 90 inches left to right. Daylight capacity ranges from 45 inches minimum to 90 inches maximum. The main-ram stroke is 45 inches, while that of each side ram is 24 inches. An ejector in the bed has a stroke of 12 inches, and a knockout incorporated in the moving platen has a stroke of 8 inches.

This giant size press weighs 1,230,000 pounds and has an overall height of 43 feet. The main ram closes and returns at a speed of 600 inches per minute and applies about 4000 tons of pressure at a speed or velocity of 300 inches per minute. Each side ram can exert a pressure of 1985 tons at a speed of 300 inches per minute. A sliding bolster with a stroke of 105 inches is provided for use in placing or locating the dies, as well as for their removal. The accompanying cut-away view shows the press as recently installed at the plant of the Harvey Machine Co., Torrance, Calif., where it will serve as auxiliary equipment in the heavy press program.

Circle Item 101 on postcard, page 241



Cut-away view of giant size forging press with powerful side rams, built by the Lake Erie Engineering Corporation

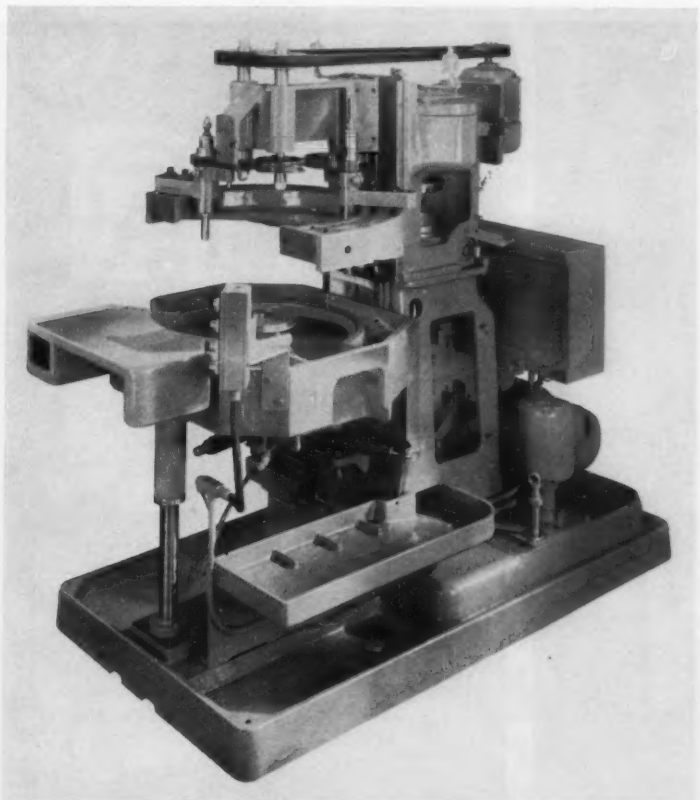
Equipment

Machine tools, unit mechanisms, machine parts, and material-handling appliances recently placed on market

Edited by FREEMAN C. DUSTON

Bodine Basic Units for Building Special Machines by "Do-It-Yourself" Plan

The Bodine Corporation, Bridgeport, Conn., is now offering basic machine units and tooling components, either separately or in any desired combination, to those who may wish partially or wholly to design and assemble their own special machines for mass production and assembly of small to medium-sized metal and plastic parts. With these basic units, special machines can be built for work cycles that include such operations as drilling, reaming, tapping, milling, screw inserting, and a wide variety of assembly jobs.



Bodine basic machine unit with front bracket removed to show spindle drive arrangement. A wide range of standard spindle units, standardized automatic feed units, and interchangeable index-tables or dials complete the tooling.

The units and components available have been designed to enable the user to construct indexing tables, feed mechanisms, and other machine elements at low cost and with a minimum of engineering and time loss. The basic machine has been developed into a proved "chassis," available in four sizes, which can be tooled for a practically unlimited range of work by the simple arrangement of standardized indexing, feed, and spindle units.

Two features of the basic machine design that have special interest for tooling and production men are: first, all operations are mechanically interlocked, eliminating complicated air feeds and electrical interlocks; secondly, once the machines are built and in operation, they can be serviced with standard inspected parts taken off the shelf. Basic units or other components sold under the Bodine plan will be the same in every respect as those used in complete engineered installations.

Circle Item 102 on postcard, page 241

Monorail Blast Cleaner

The Wheelabrator Corporation, Mishawaka, Ind., has announced a new monorail type blast cleaner. This machine, known as the "UB Wheelabrator," is designed to handle parts with open cavities that are difficult to clean. A typical application is the cleaning of cast automotive engine blocks. Another is the cleaning of welded water-tank shells before glass lining or enameling is applied.

This airless abrasive blast cleaner differs from earlier designs in that more efficient use is made of the blast-cleaning abrasive.

Thus smaller quantities of abrasive and fewer centrifugal abrasive-hurling units are required. Power costs are also reduced.

The work to be cleaned is so placed that cavities are exposed to the abrasive shower from a single hurling wheel during the entire blasting period. The crankcase cavity receives the abrasive blast from one wheel during the complete rotation of the block. The valve section and the easy-to-clean sides of the block are exposed to abrasive from two hurling wheels in the cabinet side walls.

Circle Item 103 on postcard, page 241

Bryant Vertical Model "Centalign" Automatic Grinder

The Bryant Chucking Grinder Co., Springfield, Vt., has announced a special vertical version of its new "Centalign" automatic internal grinding machine. This vertical cam grinder incorporates the principal features of the standard "Centalign," such as exceptional rigidity and stability, fast stock removal, and a high degree of accuracy. The work-head and wheel-head motions and the longitudinal and cross-slide motions of the wheel-slide are located in one common plane in order to reduce deflections to a minimum and insure permanent alignment.

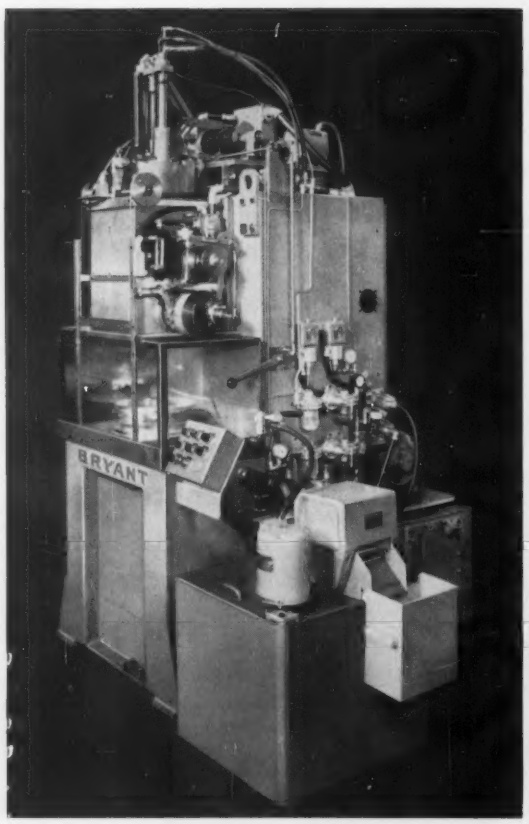
The machine functions are controlled by programming cam sets which can be readily interchanged. A simplified hydraulic servo-control system, combining the advantages of both cam and hydraulic operation, assures accurate and extremely smooth performance.

Typical of the operations handled on the vertical machine is the grinding of two-lobed bores in hydraulic pump parts at the rate of 130 to 140 pieces per hour. This compares with a production rate of thirty pieces per hour obtained by previous methods. Work parts are hand-loaded into a special chuck which rotates at a speed of 100 R.P.M. From 0.015 to 0.020 inch of stock is removed from the work.

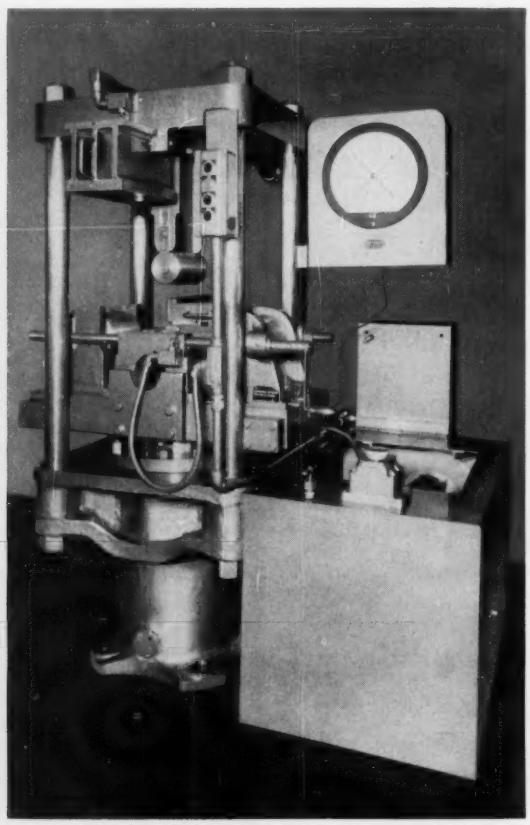
Circle Item 104 on postcard, page 241

Machine for Making Cold-Bending Tests

A machine for making cold-bending tests under loads up to 150,000 pounds has been developed by the Baldwin-Lima-Hamilton Corporation, Philadelphia, Pa. Low-carbon steel bars up to



Vertical "Centalign" automatic cam grinder announced by the Bryant Chucking Grinder Co.



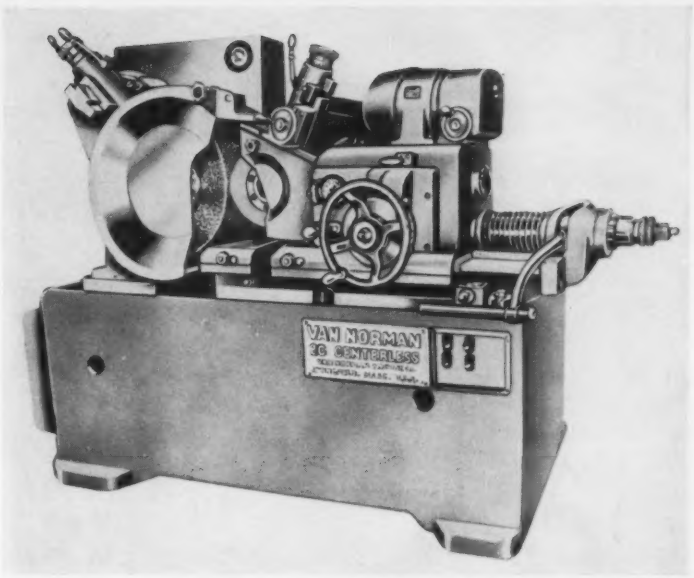
Baldwin cold-bend testing machine designed to apply bending loads up to 150,000 pounds

2 inches square or 2 inches in diameter in lengths of 5 to 24 inches can be bent in this Baldwin machine. It also accommodates flats up to 4 inches wide and 1 inch thick in the same lengths. The machine is hydraulically operated at controllable table speeds of 1 1/2 to 10 inches per minute. The maximum upward stroke is 11 inches. Loads are measured by an Emery Bourdon tube indicating system with a 12-inch diameter dial graduated in 500-pound divisions.

The machine is equipped with sliding platens which can be used, after making a V-bend with rollers, to bend specimens 180 degrees, or flat on themselves. These platens and the machine structure are designed to withstand the transfer of flattening loads located off center. Overloads are prevented by limit switches and an overload pressure relief valve.

Two support roller stands on a heavy table attached to the hydraulic piston are adjustably spaced and centered in the machine by crank-operated screws. Three pairs of support rollers—6, 5 1/2, and 5 inches in diameter—are furnished with the machine. The lower support stand has a sliding platen which can be used in the center of the machine without removing the bending pins. An assortment of bending pins ranging from 3/32 inch to 8.46 inches in diameter is provided with the machine. A roller stand and upper platen are arranged to slide interchangeably into the center of the machine on the under side of the upper fixed-position cross-head.

Circle Item 105 on postcard, page 241



Precision-built centerless grinder announced by Van Norman Machine Co.

Van Norman Centerless Grinder

The Van Norman Machine Co., Springfield, Mass., has brought out a 2C centerless grinder that will grind work up to 4 3/4 inches in diameter. This is a rugged, precision-built, heavy-duty machine incorporating many outstanding features developed to increase production capacity and insure economical precision grinding of close-tolerance work. It is said to be capable of doing the work of three centerless grinders without requiring time for change-overs. Actually, it serves as a standard centerless grinder for throughfeed work, a standard grinder for infeed jobs, and, when equipped with a crush-dressing attachment, it can be used for form-grinding and profile work.

The machine will finish-grind parts from the solid or finish-grind rough-turned parts. It is especially adapted for grinding small parts made of metal, plastics, glass, etc., such as bearings, bushings, drills, bolts, valves, and shafts.

Hard chromium-plating of the vee and flat table ways after hand scraping serves to preserve original factory built-in accuracy. The grinding wheel spindle is of unit type construction, totally enclosed with double-row super-precision bearings and sealed and lubricated for life to insure chatterless trouble-free operation. The spindle requires no warm-up period, thus "creep" is eliminated. A 1 1/2-H.P. variable-speed motor drives the regulating wheel. An enclosed and dynamically balanced 15-H.P. motor is provided for the main drive. Independent hydraulic wheel-truing devices are provided for each grinding wheel.

Fine handwheel adjustment can be employed to bring the workpiece to the required diameter. The machine is furnished with one-shot lubrication. Wheel speeds in the low range are from 10 to 57 R.P.M., and in the high range, 60 to 355 R.P.M. The weight of the grinder is about 9500 pounds.

Circle Item 106 on postcard, page 241

Coats Precision Spring Tester

Load and deflection testing of compression and extension springs can be done with extreme accuracy on a new Coats precision instrument introduced by the Carlson Co., New York City. This instrument is used for both general-purpose and high-quantity production testing at speeds up to 800 tests per hour. The instrument will apply loads from 1/4 ounce to 200 pounds. Springs up to 10 inches in length and with diameters up to 2 3/8 inches can be tested with a guaranteed accuracy within 1/4 of 1 per cent.

Automatic production stops and tolerance markers are easily adjustable for rapid production testing. A dial indicator and brackets to facilitate reading deflections to 0.001 inch are available for extremely accurate work. The instrument is 7 by 16 by 24 inches.

Circle Item 107 on postcard, page 241

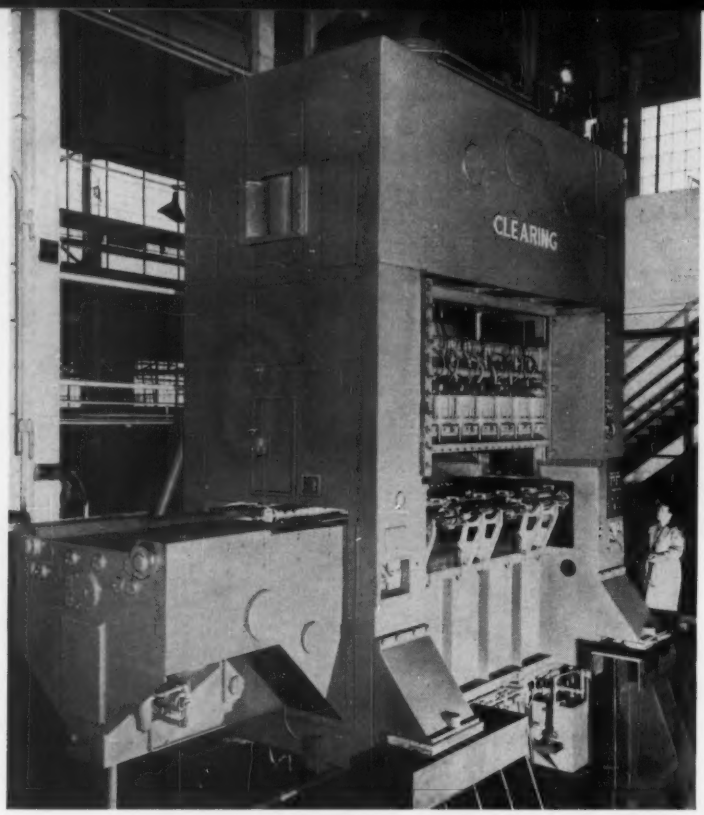
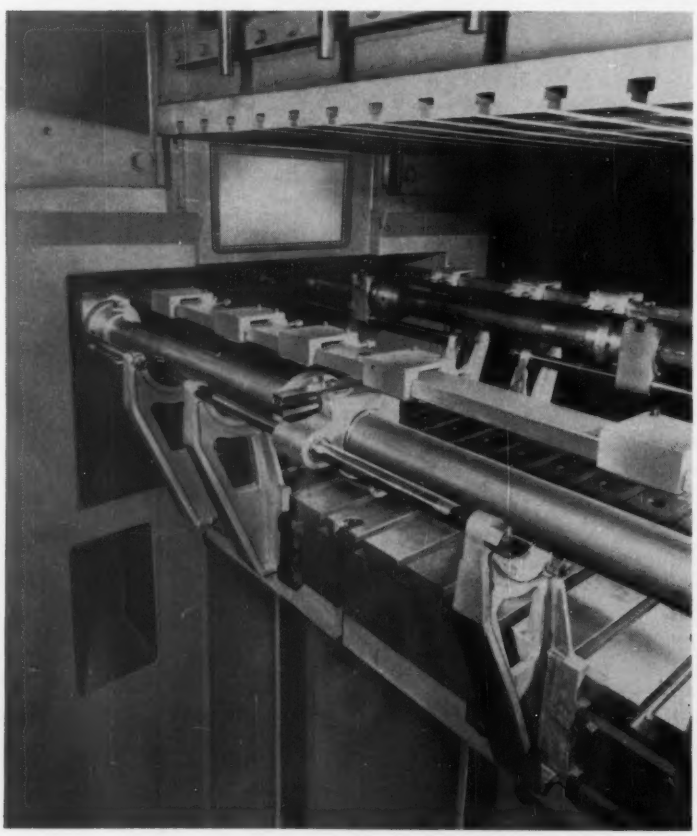


Fig. 1. (Above) "Transflex" press built by the Clearing Machine Corporation

Fig. 2. (Below) Close-up of adjustable feed mechanism of "Transflex" press



Clearing Presses Combine Automatic Operation with Versatility

"Transflex" presses designed to take full advantage of transfer press economy in handling a wide variety of work have been developed by the Clearing Machine Corporation, Division of U. S. Industries, Inc., Chicago, Ill. These presses are built especially for use in the production of a number of different parts and to permit quick change-over from one job to another.

The automatic feed that carries the work-piece through the press has been designed so that the feed-stroke is adjustable. Thus, the feed can be indexed any distance required for the number and size of dies used. Simple adjustments permit the feed-fingers to be quickly re-spaced along the feed-bar to accommodate varying feed lengths. The fingers can also be easily changed to grip parts of different dimensions.

Die cushions in a "Transflex" press are mounted on a track within the press bed. No matter where blank-holding pressure is desired, the cushions can be moved laterally to that position by an adjustment mechanism outside the bed. The presses are furnished with adjustable knock-out positions. Air cylinders eject the part when the slide is raised. A positive mechanical knock-out is also provided in the event a part becomes so firmly seated in the dies that it is not removed by the air-operated ejector. Both cylinders and rods are adjustable left and right.

Fig. 1 shows a "Transflex" press being tested on the assembly floor. The feed, shown at left, is powered by constant rotary motion taken from the drive of the press itself. The feed mechanism can be seen above and in front of the press bolster plate. "Transflex" construction keeps the feed outside of the bolster area, thus leaving the entire press die space free for installation. The adjustable knock-out cylinder can be seen on the front of the press slide. This press is also equipped with cushions which can be moved laterally so that they will be directly under

the work being handled. The handwheel that moves the cushions can be seen below the base of the press.

A close-up of the adjustable feed mechanism, Fig. 2, shows the drive tubes that have two motions imparted to them by a set of cams. The tubes move right and left through the press. This motion carries the work-piece through the various dies. The tubes also rotate. The rotation moves the finger channels in and out to provide for their clamping and unclamping motions.

Circle Item 108 on postcard, page 241

Sintox Ceramic Cutting Tool Material

A new ceramic cutting tool material, called Sintox, has been placed on the market by the Sintox Corporation of America, Allentown, Pa. Although this material is now being marketed primarily in the cutting tool industry, it is expected that it will also have important uses in other fields. Tools of the material are said to give maximum performance at all speeds and feeds even though only one grade is used. It is a low-cost, expendable material with a base of non-strategic aluminum oxide which is available in unlimited quantities. Thus, worn-out tools can be discarded rather than reground.

Originally developed in Great Britain as a spark plug insulator and later for use in the textile trades, Sintox has recently been improved to such an extent that it is now available as a very hard cutting material, its hardness being calculated to be between that of a sapphire and a diamond.

These tools are primarily used with a mechanical holder to reduce the time required for tool changing. The same tool can be employed for work ranging from heavy cuts down to a cut of only 0.00025 inch at feeds and speeds that are said to be amazing in comparison with the speeds of conventional tools. A process has been developed whereby Sintox can be metallized to permit brazing it to a holder.

Circle Item 109 on postcard, page 241

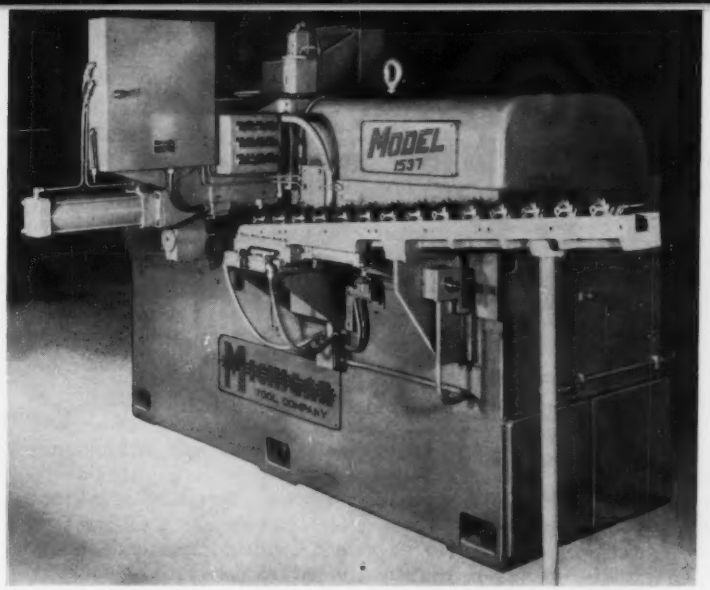


Fig. 1. Roto-Flo spline-rolling machine built by the Michigan Tool Co.

Roto-Flo Spline- and Thread-Rolling Machine

A new model Roto-Flo spline- and thread-rolling machine, capable of performing one, two, or three operations on a work-piece in a single pass, is announced by the Michigan Tool Co., Detroit, Mich. This Model 1537 Roto-Flo can roll a spline or a spline and an adjacent thread, oil-groove, etc., in a single pass of the forming racks. Under certain conditions, a third operation, such as marking, can be added.

Operations can be performed on the same or different diameters, but the forms to be rolled must be close together on the shaft. Thus, Roto-Flo "chipless machining," which is said to be up to thirty times faster than conventional methods, reduces manufacturing time still further by performing two operations in one pass. By combining these operations in a single machine, sizable reductions can be made in capital investment, floor space, and materials-handling requirements.

Basically, the Roto-Flo process is one in which the metal periphery of a part is displaced by cold-working until it assumes the shape of a spline, serration, or other desired form. The entire process takes place in a matter of seconds as one continuous operation, with the formed parts having excellent surface and tooth strength characteristics. The machine is available with automation, as shown, or in a manually loaded model. When automated, it can be operated throughout the complete forming cycle without operator attention.

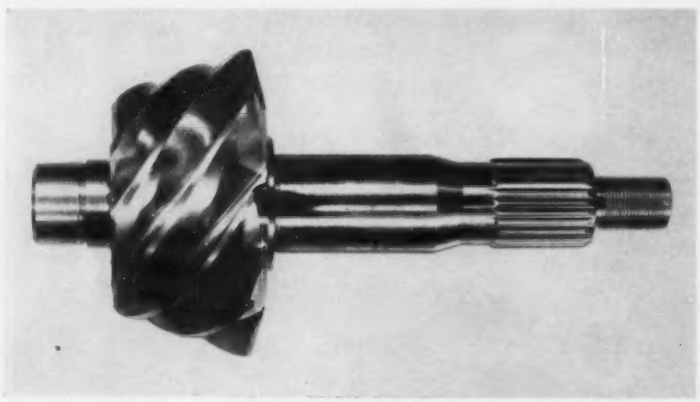


Fig. 2. Part with spline and adjacent thread rolled in a single pass

Parts with diameters ranging from 1/2 inch to 2 inches can be handled. Rack lengths used on the model shown range up to 36 inches, with the maximum stroke length being 42 inches. Part lengths that can be accommodated by either standard or universal over-arms available for the spline rollers of this machine range from 6 to 36 inches. The machine is 104 inches long, 74 inches deep, and 72 inches high. Power for the forming racks is provided by a 20-H.P. motor.

Circle Item 110 on postcard, page 241

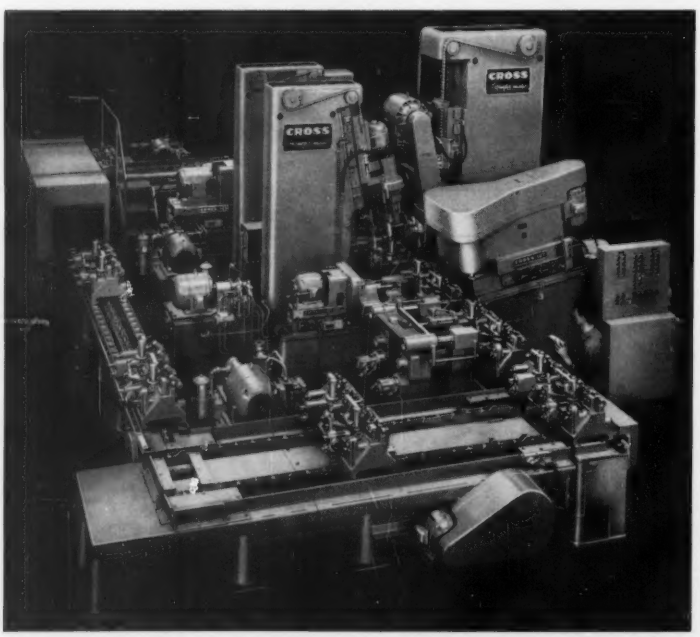
Cross Transfer-matic Built to Machine Automobile V-8 Exhaust Manifolds

The Cross Company, Detroit, Mich., has announced a Transfer-matic equipped to completely machine V-8 exhaust manifolds. This machine utilizes six stations to perform fifty-one operations, consisting of eight milling; thirty-seven drilling, chamfering, and spot-facing; and six tapping. It is designed for fast, easy maintenance, and is built on the manufacturer's modularization principle, which means the construction of machine tools from standard parts, components, and assemblies. These units facilitate the changing from one job to another.

A major feature of the machine is the reduction of down time through the incorporation of Cross pre-set tooling. This eliminates machine adjustments and trial cuts, reduces tool breakage and grinding costs, and minimizes scrapping of work.

Palletized work-holding fixtures for holding one right-hand and one left-hand manifold are provided, which are automatically operated by a hydraulic power wrench. Other features are the Cross automatic transfer mechanism; hydraulic feed and rapid traverse for milling, drilling, and boring; and individual lead-screw feed for tapping. The ways are hardened and ground. Construction is to JIC standards.

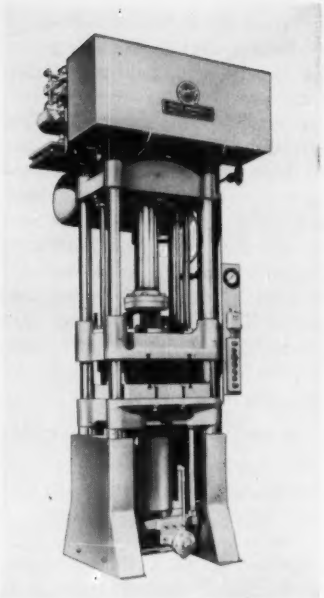
Circle Item 111 on postcard, page 241



Transfer-matic built by The Cross Company for processing V-8 exhaust manifolds

Rodgers Drawing, Forming, and Molding Press

A line of hydraulic platen presses with capacities from 50 to 400 tons has been introduced by Rodgers Hydraulic, Inc., Minneapolis, Minn. These presses are designed especially for metal drawing, metal forming, plastic molding, and ceramic molding. They are available in square or rectangular platen sizes, ranging from 18 by 18 inches to 48 by 72 inches, and will operate semi-automatically. They can also be opened and closed manually by push-buttons. The steel cylinders are ground and lapped.



Hydraulic platen press of line introduced by Rodgers Hydraulic, Inc.

Circle Item 112 on postcard, page 241

Oakite Compound for Barrel Deburring

An alkaline material, designated Oakite FM 183, is the newest addition to the line of barrel-finishing materials available from Oakite Products, Inc., New York City. This material is a fine, fast-cutting abrasive combined with surface active agents designed to keep the media bright and sharp. Its use, alone or with stones, is said to save time, cut costs, and eliminate hand filing and abrasive-belt operations. Used in concentrations of 1 to 5 ounces per gallon of water, the material is effective in deburring stamped

or machined parts, removing heat scale, and improving surface finishes.

Circle Item 113 on postcard, page 241

Unionmelt Welding Heads

A line of improved Unionmelt welding heads and assemblies for submerged-arc welding has been announced by Linde Air Products Co., a Division of Union Carbide and Carbon Corporation, New York City. The welding heads—designated UEH-1, UEH-2, and USH-2—are adaptable for a wide range of applications. The UEH-1 welding assembly is designed for heavy-duty operation. It uses an electronic voltage control and feeds wire up to 5/16 inch in diameter at currents up to 2000 amperes.

The UEH-2 and USH-2 welding heads are of the same general construction but are somewhat smaller. The UEH-2 uses an electronic speed control for constant potential welding, while the USH-2 uses the standard arc voltage control. Both machines accommodate wire up to 1/4 inch in diameter and currents up to 1200 amperes. The welding heads and mounting accessories can be used with controls and carriages already installed without changing the electric wiring.

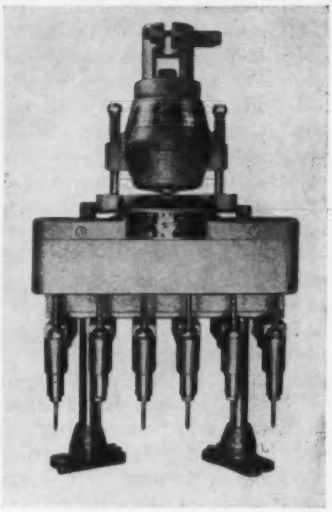
Circle Item 114 on postcard, page 241

Air-Operated Slide Feed

An air-operated slide feed of the open-throat type—designated Model ASF-12—has been added to the line of press-feeding equipment made by the U. S. Tool Company, Inc., Ampere, N. J. The standard model is available in feed lengths that are adjustable up to a maximum of 12 inches. Longer feed lengths are possible by using a counting device which can be had as extra equipment.

The feeding unit will handle stock up to 15 inches wide by 0.032 inch thick; 12 inches wide by 0.062 inch thick; and 6 inches wide by 0.125 inch thick. With this air-operated slide feed, no mechanical connections to the press are required.

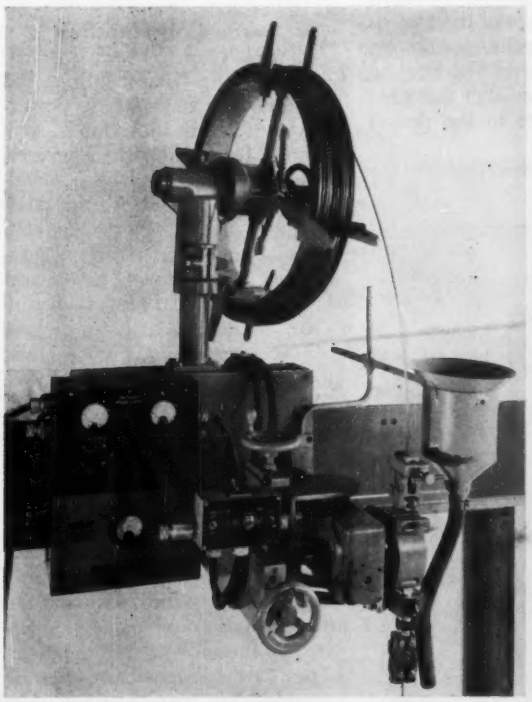
Circle Item 115 on postcard, page 241



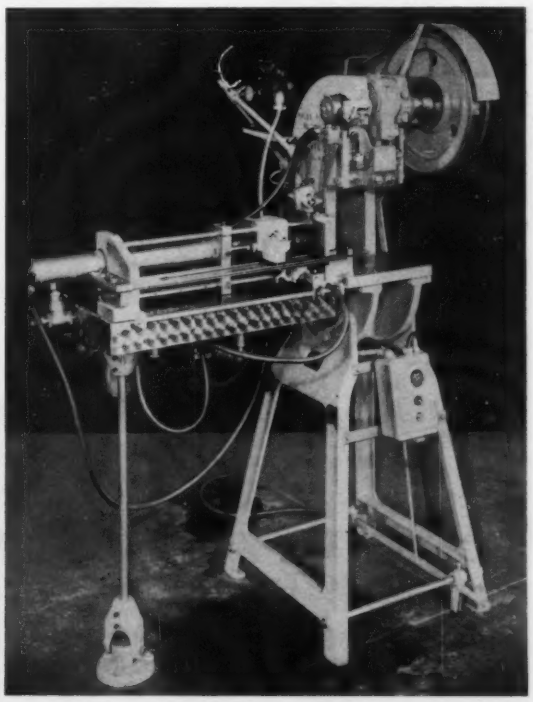
Multiple-spindle drilling or tapping machine brought out by Ettco Tool Co., Inc.

In-Line Multiple-Spindle Drilling or Tapping Head

An in-line multiple-spindle head with flexible shaft spindles arranged for drilling or tapping rectangular-shaped pieces has



Unionmelt UEH-1 welding head mounted on side-beam carriage for straight-line welding



Press equipped with air-operated slide feed made by U. S. Tool Company, Inc.

been brought out by Ettco Tool Co., Brooklyn, N. Y. Up to six holes can be tapped or drilled anywhere in a rectangular area 3 by 13 15/16 inches with this Ettco-Emrick Model 1000 straight line, multiple-spindle head. The drill head has been designed to fit any drill press. It can be set up for a wide variety of hole patterns —straight line, circular, or rectangular. The minimum distance between the centers of two spindles is 5/8 inch. This head has a capacity for drilling or tapping 5/16-inch holes in aluminum.

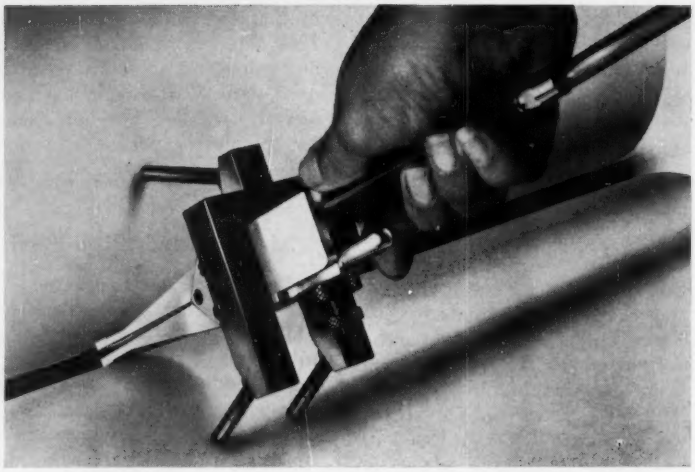
The flexible shaft drives permit the spindles to be moved or adjusted in any direction, even while the unit is running. Once the spindles are set in the desired position, they are locked in place by means of a spindle adjusting arm. Conversion from drilling to tapping is accomplished by adding a standard tapping faceplate and replacing the drill collets with floating tap collets.

Circle Item 116 on postcard, page 241

Federal Air Gage for Measuring Spacing Between Calender Rolls

An "Air-Caliper" gage for direct measuring of spacing between calender rolls to determine whether the rolls have been ground correctly throughout their full length is being offered by the Federal Products Corporation, Providence, R. I. This Model A-149 P-1 gage is of the portable caliper type that contacts the rolls directly. The measurement is transferred to an "Air-Probe," air gaging spindle. Any variation in space between rolls is shown on a "Dimensionair" dial, which is connected to the "Air-Probe" through a plastic hose. Because there is direct mechanical contact between the gage and the crowns of the calender rolls, positioning is quick and positive. The locating bars or legs assure that the gage contacts penetrate to the proper depth.

A master is used to set the calipers, and a fine adjustment screw makes it possible to zero the "Dimensionair" quickly. No further setting is required. The scissor type construction permits insertion at the point of minimum spacing between the calender rolls for fast, accurate checking along the entire length of the rolls.



Federal air gage for measuring spacing between rolls

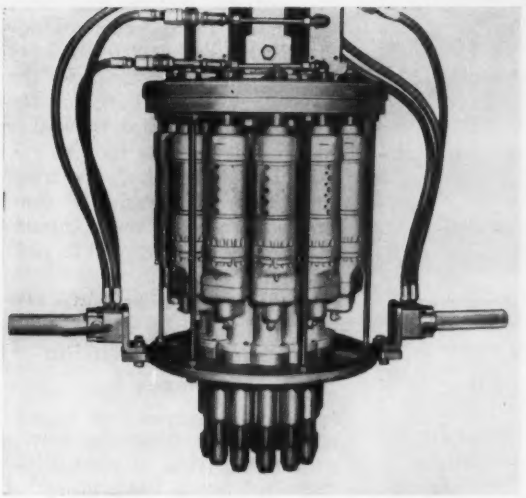
Circle Item 117 on postcard, page 241

Sesco Coil Handler

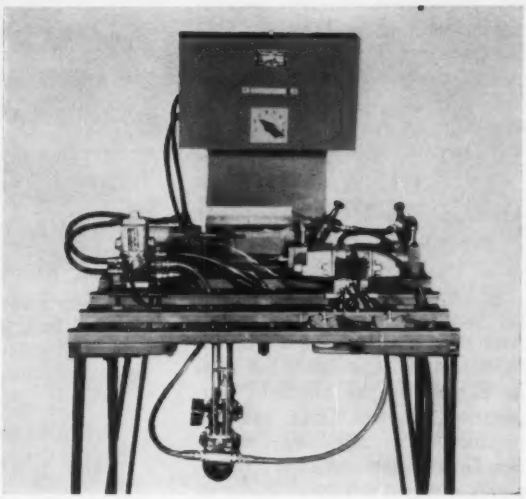
Sesco, Inc., Detroit, Mich., has introduced a heavy-duty, power-driven "Twin-In-Action" coil handler for metalworking presses. This equipment has been developed to keep pace with the tendency to use larger coils which permit longer production runs, shorter press down time, and higher production. The unit is ruggedly constructed to insure long operating life, and is designed to carry extra-heavy coil loads. It can be built to meet customer specifications and to handle coils weighing up to 40,000 pounds.

The coil handler picks up the stock on four radially contoured power-driven expander arms, eliminating the danger of mutilating any portion of the coil. The arms enter the opening at the center of the coil and are operated in unison by positive power. They are designed to permit trouble-free, easy loading. The coil is handled gently, irrespective of weight. Both reels are

"Twin-In-Action" coil handler introduced by Sesco, Inc.



Multiple nutsetter built by Thor Power Tool Co.



Valve-testing machine made by Ross Operating Valve Co.

power-driven and are synchronized to carry an equal part of the load.

The reels can be laterally adjusted, independently or in unison, making it easier to establish perfect alignment with the press or die. Uncoiling of the stock is started by merely pressing a button. The stock flow is controlled by a simple, yet rugged, electrically operated loop which adjusts the pay-off.

Circle Item 118 on postcard, page 241

Thor Multiple Nutsetter

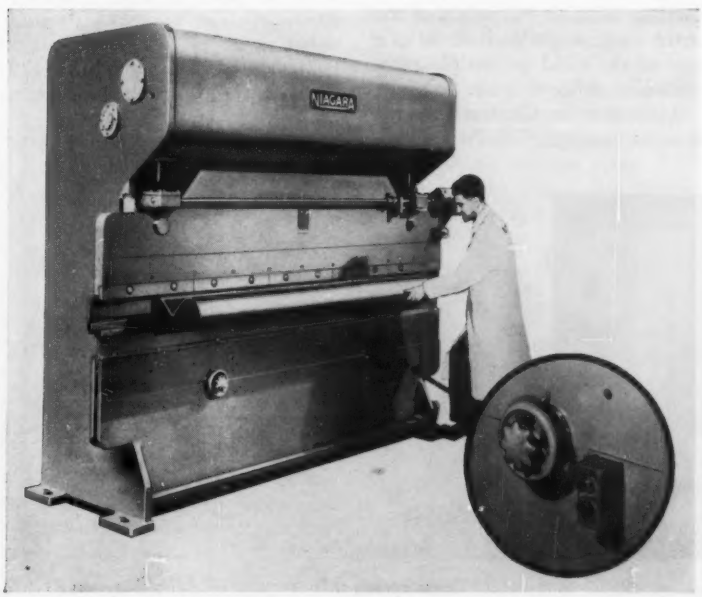
A twelve-unit, multiple nutsetter designed to tighten simultaneously a dozen nuts to a predetermined torque is one of the multiple-spindle air tools built by the Thor Power Tool Co., Aurora, Ill. The use of offset-spindle nutsetters, arranged in a compact 6 5/8-inch working circle for setting differential housing nuts, is an outstanding feature of this tool.

Circle Item 119 on postcard, page 241

Valve-Testing Machine

A valve-testing unit setup has been announced by the Ross Operating Valve Co., Detroit, Mich. A single solenoid spring-return version of the Ross Comet II is hooked up with an electrical timer control. The reading dials on this control denote the speed in piston strokes per minute that the valve is operating. On the same table is a momentary-operated Comet II valve connected to a double-acting cylinder. This valve is manually operated by two hand switches.

Circle Item 120 on postcard, page 241



Niagara front-operated power back-gage for press brakes

Front-Operated Power Back-Gage for Niagara Press Brakes

A power-driven, front-operated, micrometer back-gage is now available as optional equipment on press brakes of 50 to 150 tons capacity made by Niagara Machine & Tool Works, Buffalo, N. Y. This gage enables quick, accurate settings without requiring the operator to leave the front of the machine—an important feature when frequent gage settings are necessary.

Vernier type indicators, conveniently located on the front of the bed, are calibrated in sixty-fourths of an inch for very close settings. Two push-buttons control

the movement of the power-driven back-gage. Both ends of the gage can be adjusted to the same setting at the same time, or each end can be set individually to handle tapered work.

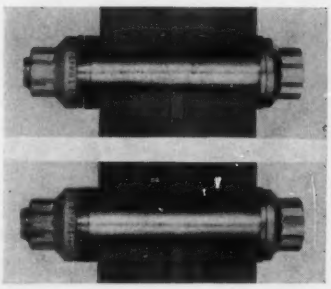
Circle Item 121 on postcard, page 241

Air Gage for Measuring Bolt Stretch Under Tension

A Precisionaire gaging device for measuring the amount of stretch that occurs when a bolt is tightened in an assembly has been developed by the Sheffield Corporation, Dayton, Ohio, and is a product of its Standard Production Instruments Division. The accompanying illustration shows an aircraft accessory assembly in a bolt tightening and gaging position. When the operator tightens a bolt, the amount it lengthens is indicated by the position of the float in the Precisionaire gage at the right. By bringing each individual bolt measurement to zero on the scale, the operator knows all bolts are under equal tension.

The gage will accommodate variations in length. A lever-operated cam mechanism retracts the locating pin and gaging pin so that the part can be revolved to the next bolt without being raised. The pivoted arm type mechanism has a floating reference point at the top which contacts the head of the bolt. There is also a pneumatic Plunjet gaging cartridge at the bottom which is activated by the gaging pin that contacts the end of the bolt.

Circle Item 122 on postcard, page 241



Cut-away views of super strength "Hi-Psi" bolt, lock-nut, and preload indicating washer

Preload Indicator for "Hi-Psi" Super Bolts

To insure controlled tightening of its new "Hi-Psi" super bolts, the Standard Pressed Steel Co., Jenkintown, Pa., has developed a preload indicating washer called the PLI 22. This device automatically preloads a "Hi-Psi" bolt to 80 per cent of the bolt yield strength, thus insuring a tight joint that is stronger and more resistant to fatigue failure from overload.

The washer consists of two concentric steel rings that are installed on either the nut or bolthead end of a connection between two standard washers. The inner ring is thicker than the outer ring—thus, it is compressed as the bolt is tightened. When the inner ring is compressed to the height of the outer ring, a preload of 80 per cent of the yield strength is automatically induced in the bolt.

Accompanying illustration shows a super strength "Hi-Psi" assembly installed—before and after tightening. Components include the 220,000- or 240,000-pound per square inch EWB-22 bolt, the EWN-22 lock-nut (left), and the PLI 22 preload indicating washer (under the nut). As the "Hi-Psi" assembly is tightened, the inner ring of the PLI washer is compressed to preload the bolt automatically to 80 per cent of its yield strength.

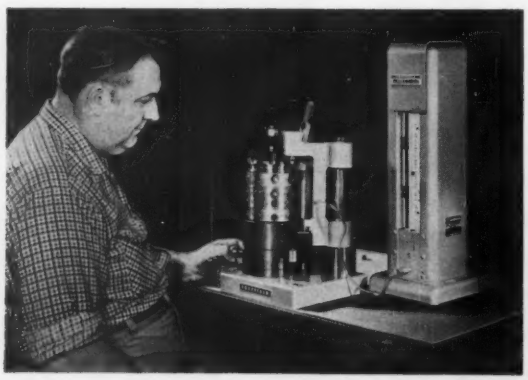
Circle Item 123 on postcard, page 241

Gram Spring Tension Gages

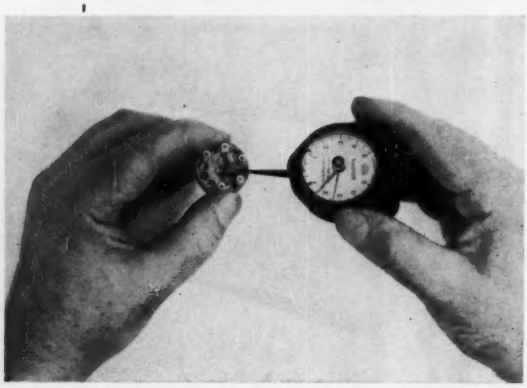
A gage for measuring minute pressures, having a range of 0.5 gram to 5 grams, has been added to the line of precision dynamometers introduced by the George Scherr Co., Inc., New York City. These gages—known as gram or spring tension gages—permit checking of spring tension far below the present range of available instruments and are especially adapted for use in the precision instrument and electronic fields. The gage illustrated is being used to check brush tension on a synchro-mechanism. This gage can be used in solving most problems concerning the measuring of extremely low pressure.

The Scherr precision dynamometer line now covers a total range from 0.5 gram to 1000 grams or its equivalent in ounces, using only nine gages. The first six gages have a dial diameter of 1 1/2 inches and the three larger ones, a diameter of 2 1/2 inches.

Circle Item 124 on postcard, page 241



Sheffield air gage for measuring bolt stretch under tension

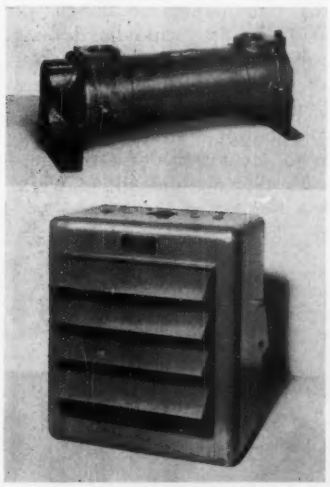


Gram spring tension gage introduced by the George Scherr Co., Inc.

Vickers Oil Coolers

Oil coolers for industrial hydraulic systems, including both air and water types, are now available from Vickers Incorporated, Detroit, Mich. The coolers are designed to provide a high rate of heat transfer per unit of space occupied. The Series OCW water type oil coolers are available in single-unit sizes for oil flow up to 100 gallons per minute and for continuous power removal up to 37 H.P. (based on 85 degrees F. entering water temperature). Larger capacity requirements can be met with two smaller coolers of equal size used in parallel. Corrosion-resistant materials are used to insure long, maintenance-free life. The maximum recommended working pressure is 75 pounds per square inch for both the oil and the water sides.

The Series OCA air type oil coolers are recommended for use where cooling water is at a premium or waste heat can be used to warm space. Their exceptionally high heat transfer rate in relation to size results from a patented turbulator that breaks up the flow for maximum dispersion of oil against the walls of the heat transfer tubes.



Vickers oil coolers for industrial hydraulic systems available as either water type (upper view) or air type (lower view)

The OCA coolers are available in single-unit sizes for oil flow up to 70 gallons per minute and for continuous power removal up to 13.2 H.P. (based on 100 degree F. average ambient temperature). Greater requirements are met with units combined in parallel. These coolers are built to operate with minimum vibration and at lowest possible noise levels. Maximum recommended oil pressure is 150 pounds per square inch.

Circle Item 125 on postcard, page 241

Totally enclosed shaded-pole motor announced by the General Electric Co.

G-E Totally Enclosed Shaded-Pole Motor

A totally enclosed, shaded-pole motor, designed for high output applications such as ceiling-hung, gas-fired unit heaters, has been developed by the Specialty Component Motor Department, General Electric Co., Schenectady, N. Y. A "Sealed-in" lubrication system eliminates need for re-oiling or servicing in normal use. Available in ratings from 1/15 through 1/10 H.P., this thirty-nine-frame motor has a diameter of 5 1/2 inches. The totally enclosed line of shaded-pole motors now ranges from 1.5 watts output through 1/10 H.P. at both 4- and 6-pole speeds. In G-E's open motor design, the economy of shaded-pole motor construction extends through 1/4 H.P. A special "oil pump" groove on the shaft provides continuous replacement of cooled, filtered oil on the bearing surfaces. Dual oil-impervious slingers help "seal-in" recirculating lubricant, reducing service requirements on motors.

Circle Item 126 on postcard, page 241

Face of automation limit switch developed by the E. W. Bliss Co.

Bliss Automation Limit Switch

A nine-point mechanical rotary limit switch that can be used in the automation of a wide variety of machine operations or sequence of operations has been announced by the E. W. Bliss Co., Canton, Ohio. This switch was developed to control the starting, stopping, and interlocking of motion, time, sequence, and recycling of press auxiliary equipment such as dopers, kickers, and feeds. It has been used very successfully as a control for Bliss presses as well as other makes of presses employed in the automotive industry.

The basic design of the switch and the ease with which it can be coupled into existing control circuits make it applicable to many machines and processes outside the press field.

Precision timing permits presetting each station to operate within 1 degree of arc, and final micro-adjustment reduces this error to less than 1/4 degree. When the cam is turning at the rate of 30 R.P.M., the error in timing of each switch can never be more than 1.4 thousandths of a second.

Two models of the automation limit switch are available—the nine-station unit illustrated and a four-station unit for relatively simple applications. By assembling several nine-station switches on a single drive, any number of separate operating steps can be controlled. Terminal blocks are clearly marked as to the normal circuit and the switch to which they are wired.

Circle Item 127 on postcard, page 241

Injection Molding Machine

A 275T 8- to 10-ounce plastic injection molding machine with a dry cycle time of under eight seconds, which is said to be faster than the 10D 8-ounce machine which it replaces, has been announced by the Reed-Prentice Corporation, Worcester, Mass. The plasticizing capacity of this machine is 20 per cent greater than that of the preceding model. A newly designed heating cylinder plasticizes up to 120 pounds of material per hour, and a tapered spreader creates a mulling action for thorough plasticizing. Four-zone temperature control—three on the heater and one on the nozzle—insures precise control of plasticizing.

The mold-clamping stroke is readily adjustable between 6 1/4 and 10 1/4 inches. Injection speeds can be varied from 79.2 inches per minute with two booster pumps to 148 inches per minute using three pumps. The rate of injection is 800 cubic inches per minute, and the machine develops 275 tons positive mechanical mold-locking pressure. The rated projected casting area is 125 square inches. Mold platens measure 22 1/2 by 25 inches with 11 1/4 by 14 1/4 inches between the bars.

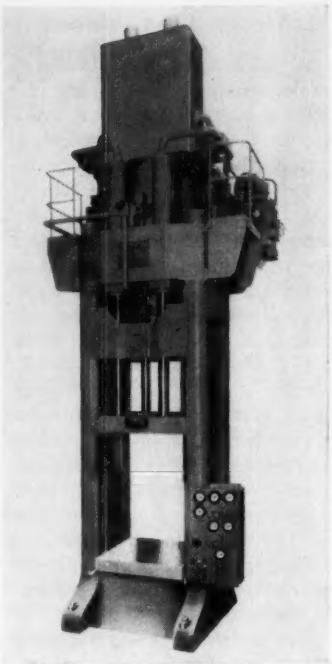
A palm type safety button can be pressed to automatically open the dies during any part of the machine cycle and withdraw the plunger housing. The front safety door is equipped with both hydraulic and electrical interlocks. A large fixed guard covers the rear platen area.

Circle Item 128 on postcard, page 241

Farquhar Triple-Acting Hydraulic Press

A triple-acting hydraulic press with electric magnetic controls has been announced by the A. B. Farquhar Division, Oliver Corporation, York, Pa. The new electric magnetic controls of this 575-ton press enable the operator to make adjustments of speed, timing, and pressure from the main control panel on the press. For instance, the ram can be made to approach at maximum speed, slow down as it enters the draw, change speed during the draw, strip slowly, speed up, slow down again to pick up the blank-holder, and return to the top starting position at maximum speed.

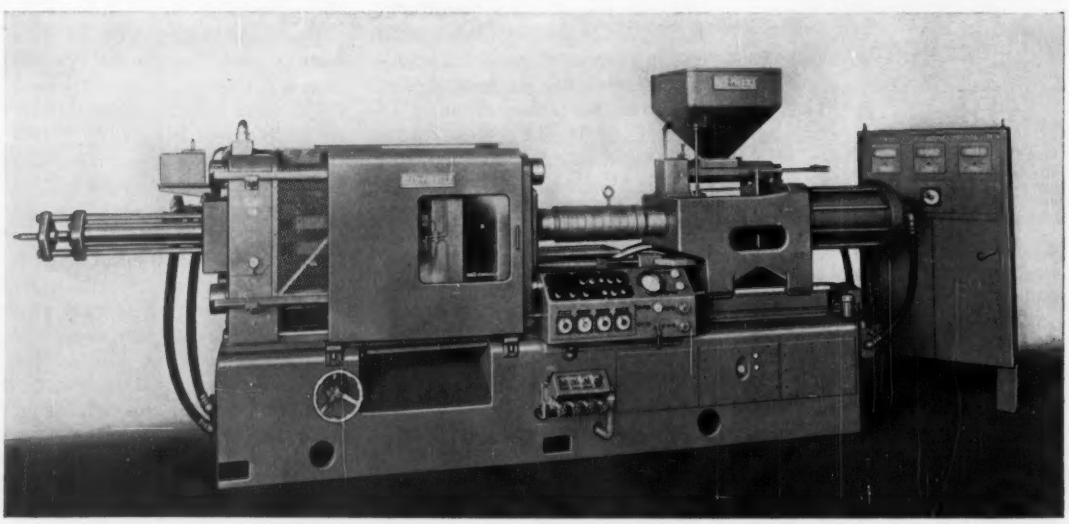
The cycle pattern can be changed to a new setup simply by resetting six knobs on the main control panel, no cams being used to make the speed changes. This flexibility in cycle timing is said to provide additional protection for the dies by applying "easy" pressure at the point of contact and withdrawal.



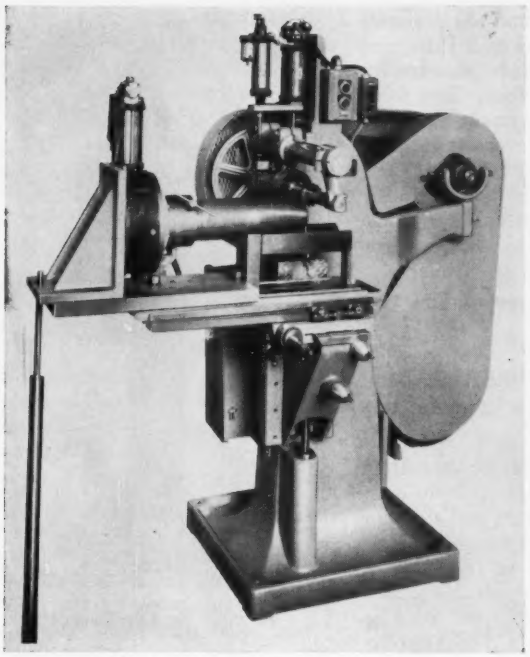
Farquhar triple-acting hydraulic press with panel containing all setting up and operating controls

By eliminating the danger of building up work-hardening stresses during the press stroke—a direct result of the development of the new electric magnetic cycle-control system—it is possible to accurately draw-form materials that are difficult to work.

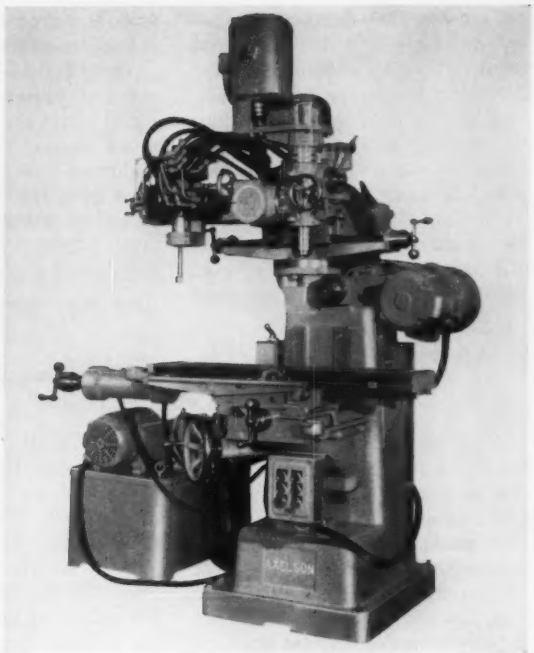
Circle Item 129 on postcard, page 241



Reed-Prentice injection molding machine with precise plasticizing control



Milling machine equipped for stake-notching operation made by the U. S. Burke Machine Tool Division



Milling machine with three-dimensional hydraulic duplicator produced by the Axelson Mfg. Co.

Milling Machine Equipped for Stake-Notching Operation on Projectiles

A milling machine manufactured by the U. S. Burke Machine Tool Division, Cincinnati, Ohio, equipped for automatic feeding and indexing, is being used for semi-automatic stake notching of 105-millimeter and other projectiles on a production basis. The head of this U. S. No. 1 milling machine is provided with a 4-inch stroke air-hydraulic feed which gives a rapid traverse approach, controlled cutting speed to depth, and automatic rapid return. The projectile is held in a cup type collet secured to the center of a pneumatic rotary table. The table has a five-division index-plate, and its operation is coordinated with that of the head feed by the use of limit switches.

The projectile is moved from the factory conveyor line into a grooved fixture and slid into position in the cup type collet. A partial turning of the locking handle secures the work in place. The operator then presses the starting button to mill the first stake notch. At the conclusion of the milling stroke, the head retracts at rapid traverse, and the rotary table is indexed to the next position. The head again descends, and the operation continues automatically until all five notches are milled.

At the conclusion of the milling operation, an externally mounted dog, located on the periphery of the rotary table, trips a limit switch, which keeps the head in a raised position awaiting the insertion of the next shell. With a setup of this type, one operator can handle two machines. During the entire operation, the table of the milling machine is kept in the same position, thus saving considerable floor space and permitting the factory conveyor line to be brought to the edge of the table. This eliminates lifting the shells and, therefore, reduces operator fatigue.

The machine can be equipped with air-hydraulic table feeds to provide automatic cycling, "skip" feeds for milling two work-pieces per pass, or two spindles for a variety of production milling.

Circle Item 130 on postcard, page 241

Axelson Three-Dimensional Milling Machine

A milling machine that will perform milling, jig-boring, and three-dimensional duplicating work is being produced by the Axelson Mfg. Co., Division of U. S. Industries, Inc., Los Angeles, Calif. This Model 10RH machine has a hydraulic attachment for making duplicate molds and dies or for contour-milling to templates.

The duplicator sensing tracer head of the attachment controls the movement of the table, knee, and ram slide. As the operator moves the stylus over the master, the cutter duplicates his movements. Only 4 ounces of stylus pressure is required to accurately reproduce a metal, plastic, or wood master. The machine is designed to permit operation by semiskilled labor at maximum unit efficiency. It can be used as a duplicator or as a conventional mill for experimental, prototype, or production work.

A unique feature is the reversible ram turret with an all-angle head at one end and a slotting head at the other. The entire tur-

ret rotates 360 degrees so that the machine can be converted from milling to slotting in a few seconds. Any compound-angle setting can be easily obtained. Both the vertical and horizontal heads have No. 30 NST spindle tapers which facilitate interchangeability of tooling. The vertical spindle has speed changes from 75 to 6400 R.P.M. at full 1 1/2-H.P. torque. Speed changes for the horizontal spindle range from 55 to 3600 R.P.M. at either 1 or 2 H.P.

The 42- by 9-inch table has an optional power feed. The combined turret slide and table travel is 44 inches. Travel of the ram and cross-slide is 26 inches. Clearance from spindle to table top is 22 inches. A magnetic tracer valve and 14,000-R.P.M. heads (for high-speed work) are available.

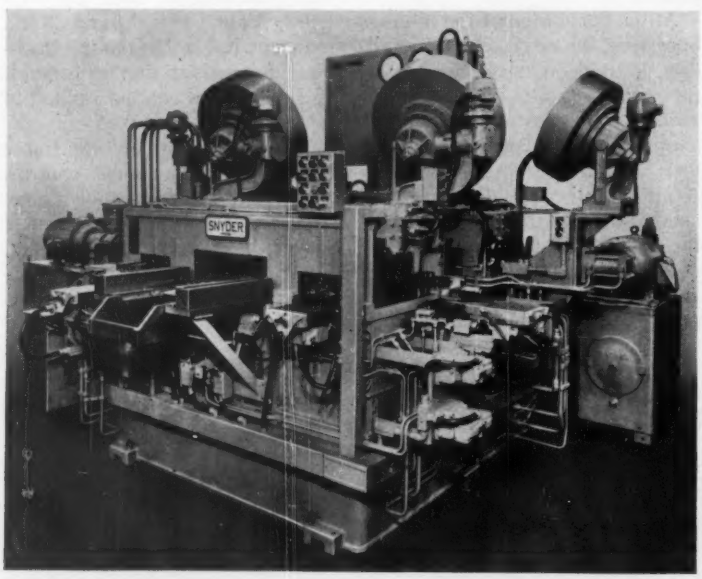
Circle Item 131 on postcard, page 241

Snyder Automatic Machine for Assembling and Testing Cylinder Heads

A seven-station, in-line automatic machine that applies sealer material and assembles welch plugs in automotive-engine cylinder heads, as well as tests the finished assemblies, has been built by Snyder Tool & Engineering Co., Detroit, Mich. The cylinder heads are loaded into the machine from a conveyor. In automatic sequence, the machine applies sealing compound to three holes in the cylinder head, presses in three welch plugs, air tests the assembly for leaks, rejects faulty heads from the line, and unloads the head and plug assembly onto a conveyor line.

The machine assembles 130 heads per hour at 80 per cent efficiency, making right- and left-hand cylinder heads by alternately pressing plugs into opposite ends of the heads as they pass through the machine. Any repaired heads can be returned to the transfer line. The finish-tested assemblies are unloaded onto a conveyor at the seventh station. The machine has a centralized lubrication system and occupies a floor space about 14 by 14 feet.

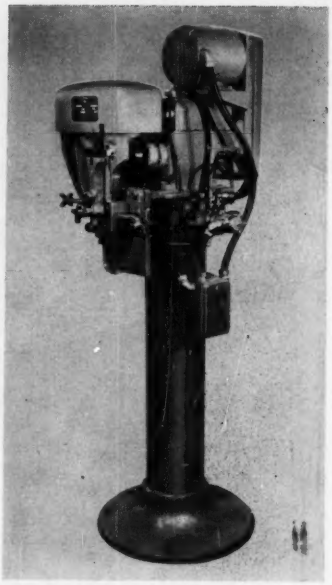
Circle Item 132 on postcard, page 241



Automatic machine for assembling and testing automotive cylinder heads built by Snyder Tool & Engineering Co.

Template-Controlled "Speedy Driller"

The high-speed, automatic "Speedy Driller," introduced by the Fairchild Engine & Airplane Corporation, Hagerstown, Md., and announced in April, 1956, MACHINERY, page 227, is finding a wide range of applications in the building as well as the aircraft and automotive industries.



Fairchild "Speedy Driller"

This lightweight, portable machine was developed and is now being manufactured by Fairchild's Speed Control Division in St. Augustine, Fla. It is designed to reduce to a minimum the tooling costs and time required for drilling operations. In addition, the rapid-fire automated indexing feature is said to cut the time lapse between drilling operations, thereby establishing production rates with a single drill that are comparable to those of setups employing spindle heads, index-tables, and drill jigs.

The complete machine weighs 365 pounds, is pedestal-mounted, and requires less than 4 square feet of floor space. It is operated from a 1/3-HP., 220- to 440-volt, 3-phase, 60-cycle, alternating- current motor and 80 pounds of air pressure. A 1/6-HP., single-phase, 110-volt drill unit can be furnished where drilling requirements do not exceed 3/32-inch diameter holes in thin sheet stock.

Drill size capacity ranges from No. 80 (0.0135 inch) to and including 3/8 inch. Maximum drill travel is 1 1/2 inches. Holes from

0.094 to 0.156 inch in diameter can be drilled through 1/16-inch thick aluminum at the rate of 180 per minute and through mild steel at the rate of 170 per minute. Holes from 5/16 to 3/8 inch in diameter can be drilled through aluminum 3/16 inch thick at the rate of 80 per minute.

Circle Item 133 on postcard, page 241

Heald "Bore-Matic" Equipped for Simultaneous Boring of Differential-Housing Flanges

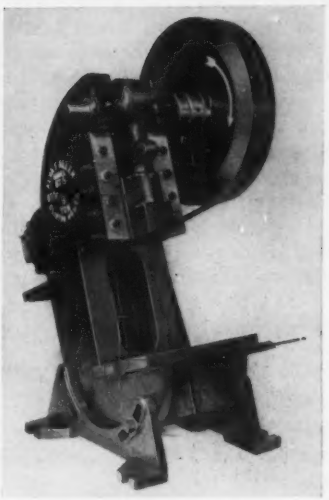
The Heald Machine Co., Worcester, Mass., has brought out a Model S "Bore-Matic" equipped for precision borizing both ends of an automotive differential housing simultaneously. The steel work-piece is over 4 feet long and is held between two angle-plate fixtures. It is stabilized at its mid-section by a horizontal platen. The left-hand angle-plate is secured to the base. The movable right-hand angle-plate is hydraulically actuated, clamping the work-piece flange faces. Locating holes in the flange face receive round and two-way locating pins.

An interesting feature of this machine is the fact that while boring operations are being done simultaneously 50 inches apart, tolerances and concentricity are held to close limits. The design of this machine also makes it possible to bore both ends of the part at one clamping. Another notable feature is the use of feed-out tools to eliminate a tool drag line or spiral normally present in one-way boring operations. Air-operated push-rods, working through hollow boring-head spindles, advance tools to correct positions for in-boring and retract tools prior to table run-out, eliminating the necessity of boring out to avoid drag line.

The bearing and oil-seal surfaces and adjacent chamfers are borized to the required diameters. With 0.015-inch stock removal, diameters are held to a tolerance of 0.002 inch. Production, based on 70 per cent efficiency, is thirty-six housings per hour.

A hydraulic unit mounted at the rear of the machine provides all the power for the horizontally opposed slide units which carry tooling to the work-piece. Except for loading operations, all machine functions are controlled from the push-button station.

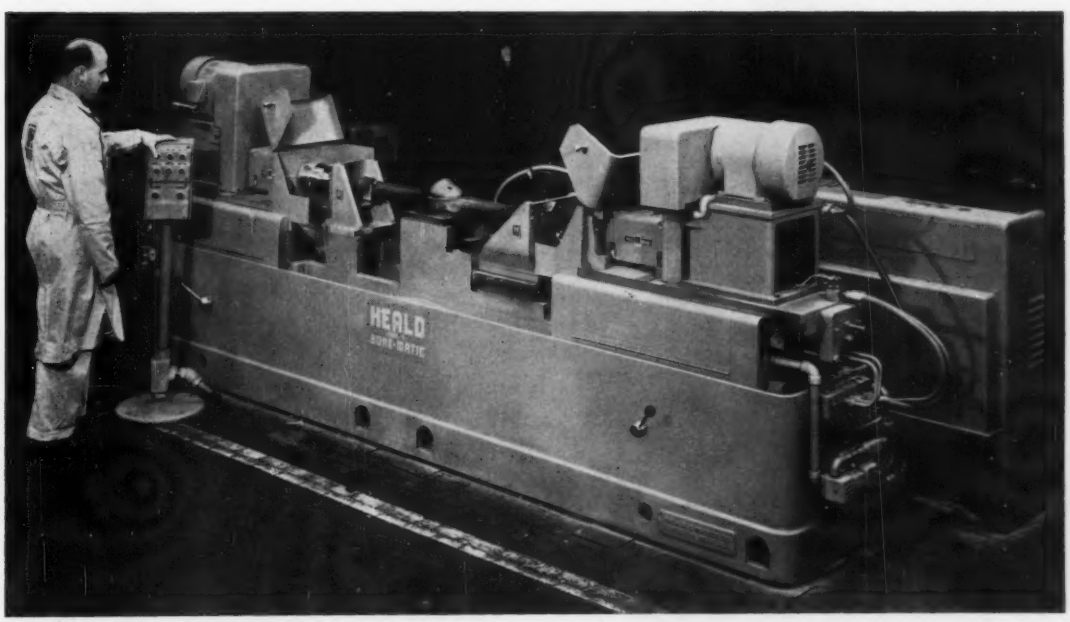
Circle Item 134 on postcard, page 241



Heavy-duty punch press announced by Alva Allen Industries

Heavy-Duty Punch Press

A heavy-duty, 5-ton press that will perform up to 280 operations per minute on continuous punching, shearing, forming, riveting, blanking, cutting, and drawing work is announced by Alva Allen Industries, Clinton, Mo. This press, designated Model B-5, will perform operations on leather, fiber, plastics, textiles, paper, metal, or any workable material.



"Bore-Matic" equipped for processing differential-housing flanges

The 65-pound flywheel provides ample power for heavy-duty operations. The upper connecting-rod and ram assembly is unitized to assure accurate alignment of crankshaft and die-bed. Lubrication of the large connecting-rod and crankshaft bearings is through a Zerk fitting.

The new synchronized, positive, single-pin, quick-acting, repeat or non-repeat clutch is of simplified construction. All contact parts are heat-treated to give hard, long-wearing surfaces. The press can be easily interchanged for repeat or non-repeat operation. It has a standard stroke of 1 1/4 inches, and presses with 1/4- to 2-inch strokes are available at an additional charge. The press has a V-belt drive, a 1/3-H.P. motor, and weighs 265 pounds.

Circle Item 135 on postcard, page 241

Little "Giant" Automated Drilling, Chamfering, and Tapping Machine

A completely automatic machine, designed to drill, chamfer, and tap a 5/8-18 hole in flange nuts at the rate of 750 per hour, is a recent development of the Michigan Drill Head Co., Detroit, Mich. The completed parts are ejected into chutes, as shown in the illustration. This machine is built to JIC hydraulic and electrical standards and has automatic lubrication throughout. A self-contained coolant tank built into the base of the machine is designed for easy accessibility and features an outside clean-out.

This special machine has been engineered and built to use standard components. They include a standard Hydro 3 vertical unit, with a six-spindle combination drill and individual lead-screw tapping head, and a 20-inch, five-station, two-place fixture with power clamping and an automatic ejector.

Circle Item 136 on postcard, page 241

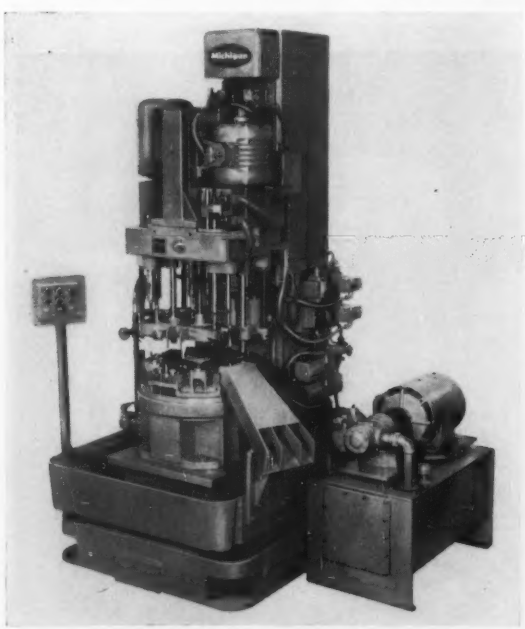
Dexter Metal-Sheet Feeder

The Dexter Folder Co., Pearl River, N. Y., has redesigned its 6000-pound capacity metal-sheet feeder to handle sheets at a continuous rate of up to 125 per minute throughout multi-shift operating schedules. The new machine is of particularly rugged construction, designed to withstand the strains of operating at high speeds for long periods.

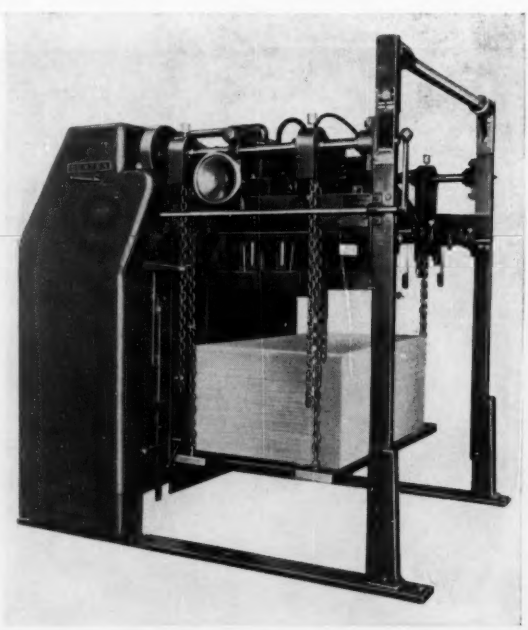
The feeder automatically separates, lifts, calipers, and advances sheets up to 44 by 48 inches in size to the registering or feeding station of the press, coater, slitter, shear, or other machine to which it is attached. Tin plate, black iron, or other metal sheets may be fed in thicknesses ranging from 38 gage (about 0.0062 inch) to 20 gage (about 0.037 inch), while special features available as optional equipment can extend this range to 18 gage (about 0.050 inch).

The feeder can be equipped for either rear or side loading. Pile position is adjusted by a manually operated shifter bar on the elevator, while a pile height governor automatically maintains the top sheet of the pile at exactly the right level for precision feeding. Sheet separation is accomplished by timed suction cups and blasts of filtered air, aided by permanent magnets when ferrous material is being run.

Double, wrinkled, or damaged sheets are diverted from the feed line without stopping by means of mechanical fingers which cali-



Drilling, chamfering, and tapping machine built by the Michigan Drill Head Co.



Metal-sheet feeding machine placed on the market by the Dexter Folder Co.

per each sheet and carry rejected ones to a tray above the conveyor. Should it be necessary to halt the flow of sheets temporarily, this can be done from either side of the feeder by controls which cut off suction without stopping the rest of the feeder. In this way, when flow is resumed, the feeder will still be synchronized with the operating cycle of the fed machine.

For reloading, a fast-lowering elevator drops to reload position in approximately twenty seconds to allow reload forks to position a new pile on the elevator. The powered elevator is then speedily raised to the feeding position, reducing over-all reload time to a minimum. The feeder can be driven by a power take-off from the fed machine or it can be supplied with an independent drive.

Circle Item 137 on postcard, page 241

Curtiss-Wright Ultrasonic Degreasers

The first of a new series of ultrasonic degreasers has been announced by the Industrial and Scientific Products Division of the Curtiss-Wright Corporation, Caldwell, N. J. Designed for rapid and thorough cleaning of fabricated parts in preparation for finishing or assembly, the unit is 24 by 10 by 18 inches deep and can accommodate work-pieces 8 by 8 by 10 inches. Two cleaning stages are featured—vapor degreasing and ultrasonic solvent cleaning—usable in the order desired. Solvents such as trichlorethylene can be used.

Features of this new equipment are easy serviceability, high-quality construction, and convenient operating controls. Built-in components consist of pump, filter, solvent spray, heater, thermostats, and vapor condenser. The degreaser is available in stainless- or zinc-clad steel or solid stainless steel. The ultrasonic transducer may be shifted in its compartment and can be easily removed.

Ultrasonic power up to 500 watts at 40-kilocycle frequency is available over an area 7 by 9 inches. The generator is housed in a separate unit.

Circle Item 138 on postcard, page 241

Fig. 1. Ex-Cell-O Style 17-A precision boring machine arranged to mill two parts per cycle in continuous operation

Boring Machine Equipped for Continuous Milling Operation on Automotive Parts

With its spindles running continuously, the double-end precision boring machine, Fig. 1, built by the Ex-Cell-O Corporation, Detroit, Mich., is attaining double the old production rate in the milling of a steel propeller-shaft pinion flange. Machining operations consist of facing and undercutting with milling cutters at two places on each part, as illustrated in Figs. 2 and 3.

The machine is a basic Ex-Cell-O precision boring machine with extra-wide bridges for transverse mounting of the spin-

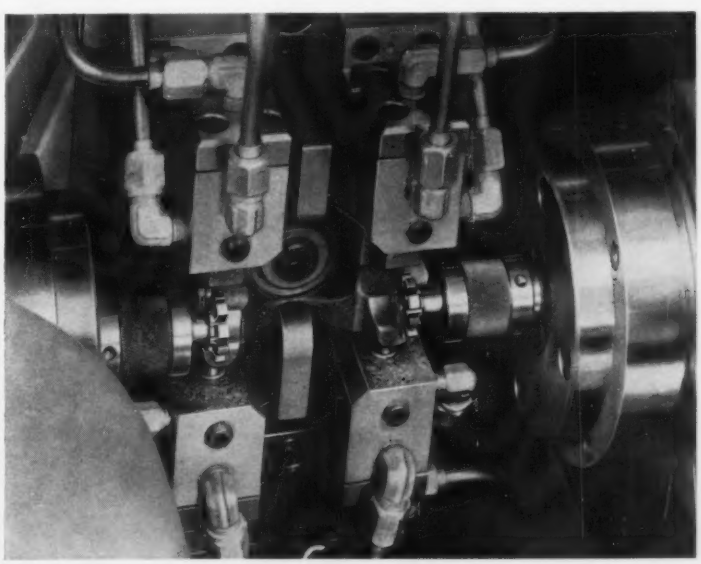


Fig. 2. Close-up view of part clamped in fixture of machine shown in Fig. 1. The table feeds work to the rotating cutters

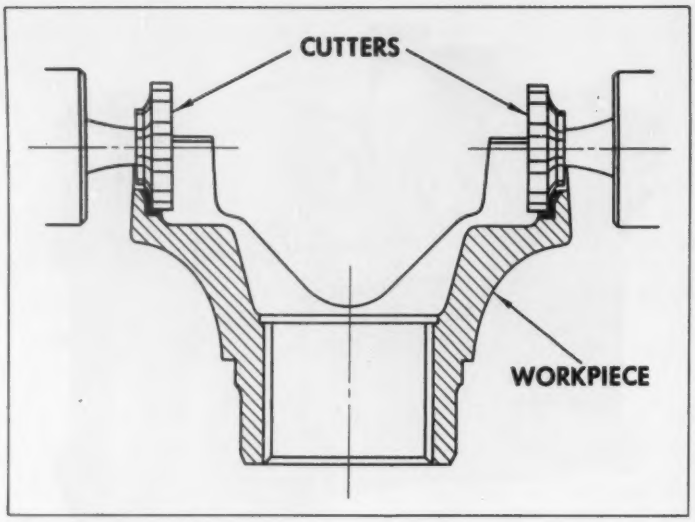


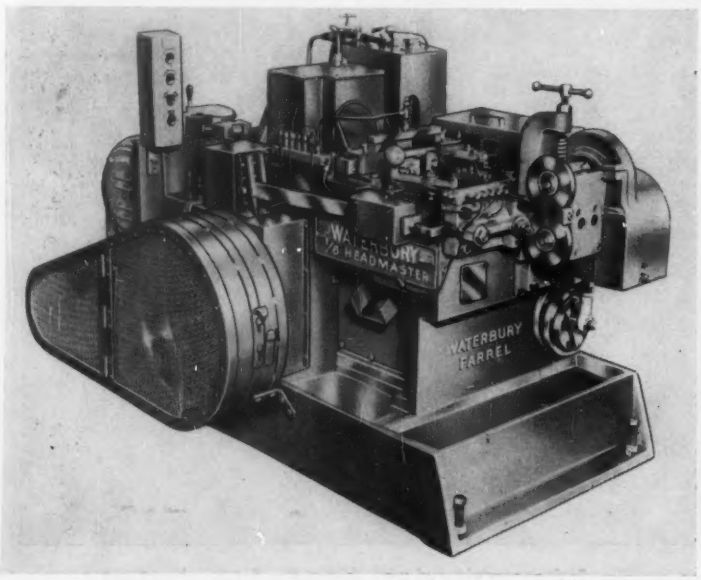
Fig. 3. In this diagram the heavy areas show cuts taken by boring machine seen in Fig. 1

dles. It is arranged for both automatic and manually controlled operation. One part is loaded while a second part is being machined, resulting in a net production rate of 188 parts per hour. The work-piece is held in position by push-button-operated hydraulic clamps. Safety devices prevent operation of the machine if a part is improperly loaded or clamped.

Circle Item 139 on postcard, page 241

Double-Stroke Cold-Heading Machine

A solid die, double-stroke cold-heading machine developed by the Waterbury Farrel Foundry & Machine Co., Waterbury, Conn., will produce from 300 to 450 screw or rivet blanks per minute. Named the "Headmaster," this machine will head rivets up to 1/8 by 3/4 inch, machine screws up to No. 6 by 3/4 inch, and sheet-metal screws up to No. 8 by 3/4 inch. It can be equipped with either standard or Phillips type tooling.



Waterbury Farrel double-stroke cold-heading machine

This machine is claimed to be the fastest solid die, double-stroke header available. It combines outstanding features from several different types of Waterbury Farrel heading machines, including horizontal shifting punches; toggle-actuated gate mounted on rods; friction roll feed; individually adjustable punch-holders; cam-operated shifter and cut-off; magnetic brake; sturdy cut-off and transfer lever; shafts mounted in roller bearings; centralized lubrication system; and variable-speed drive.

The toggle-actuated gate mechanism provides two cold-heading blows—one long stroke and one short stroke—for each flywheel revolution. The gate advances rapidly and then decelerates on contact with the blank, producing a squeezing action rather than an abrupt blow.

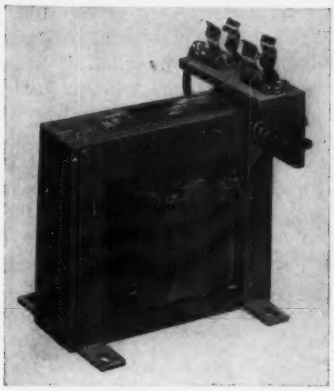
Circle Item 140 on postcard, page 241

Westinghouse Transformers for Machine Tools

A new line of transformers designed for machine tool applications, rated from 0.075 to 1.5 K.V.A., are available from the Westinghouse Electric Corporation, Pittsburgh, Pa. These units provide stepped-down voltage for machine tool control devices and permit isolation of control circuits from power and lighting circuits. The new transformers operate at primary voltages from 230 to 575 volts, single phase, 50 to 60 cycles, and are designed for 55 degrees C. temperature rise.

In addition to a wide choice of primary voltages on the 50- or 60-cycle ratings, a 95-volt secondary tap is provided to permit use of 115-volt, 60-cycle solenoid coils. The transformers have good regulation at all power factors and are particularly adapted to the inductive, low power-factor loads of solenoids, relays, and contactors found in machine tool control equipment.

Lug type terminals on the coils



Transformer for machine tool applications announced by Westinghouse Electric Corporation

keep the over-all size of the transformers to a minimum for panel mounting. Although all transformers are normally supplied without any protective arrangement, a new add-a-part protective device kit is available for all ratings. It consists of a conventional 250-volt cartridge type fuse-holder and the necessary accessory equipment, which the user can mount on the transformer. An add-a-part kit is also available with a circuit-breaker instead of a fuse for the 1- and 1 1/2-K.V.A. ratings. Class A insulation is used. The core and coil assembly is impregnated and baked with an insulating varnish that dust- and moisture-laden air cannot penetrate.

Circle Item 141 on postcard, page 241

Automatic Cabinet Type Cleaning Machine

A completely automatic washer, called the "Ransomatic," which can process up to forty baskets of small parts per hour has been developed by Ransohoff, Inc., Hamilton, Ohio. The maximum over-all size of each basket is 21 1/2 by 14 3/4 by 14 inches. Two baskets are loaded into the cabinet and the door is closed. This starts an automatic, adjustable-time cleaning cycle in the following sequence: hot recirculated cleaning solution spray for thirty seconds; hot-water rinse spray for sixty seconds; and a drain-dry for ninety seconds.

The machine is designed so that wash, rinse, and drain-dry periods are widely variable to suit the work. In the rinse operation, the parts accumulate enough latent heat to air-dry themselves after the excess water drains off. However, a hot-air drier can be added to the machine when required.

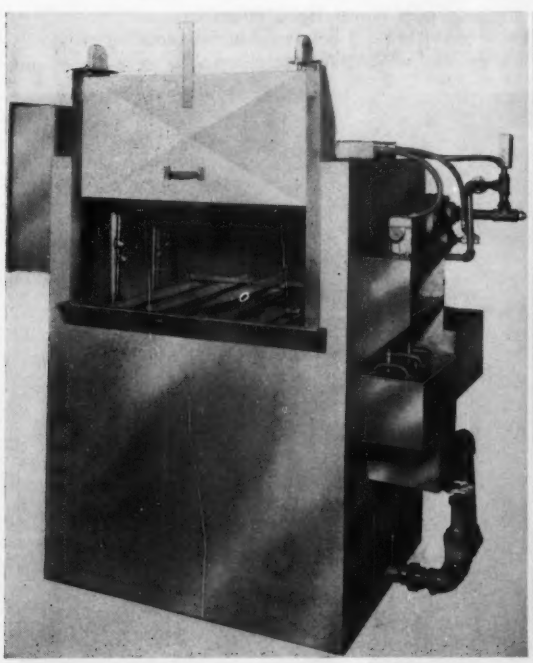
At the completion of the cleaning cycle, the door of the washer opens automatically and the baskets or racks of parts are unloaded by the operator. The door remains closed while the automatic washing and rinsing cycle is in progress, assuring thorough cleaning and providing operator safety.

Circle Item 142 on postcard, page 241

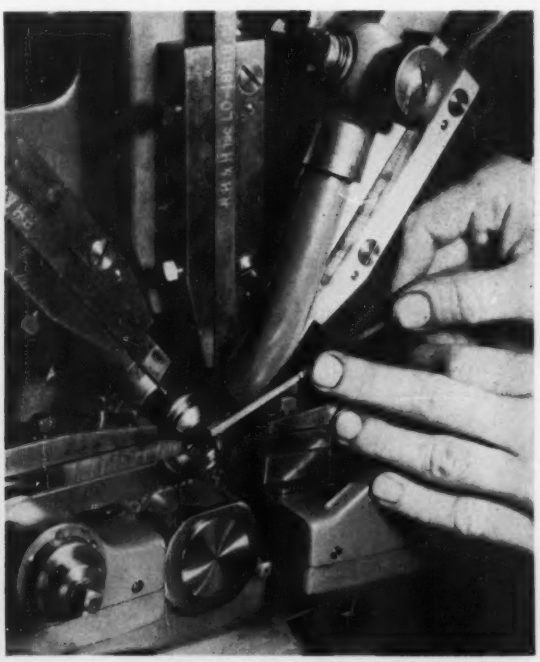
Starlite Diamond Hand Files

Tools and dies can be dressed or sharpened without removing them from the machine by using the new diamond hand files brought out by Starlite Industries, Inc., Philadelphia, Pa. These diamond hand files can also be used anywhere a conventional hone would be employed. They are available in six convenient shapes with "block-shaped" diamonds in a very high concentration for fast cutting. Excellent results are said to be obtained when the diamond files are used on carbide, ceramics, hardened steel, quartz, sapphire, and titanium.

Circle Item 143 on postcard, page 241



"Ransomatic" small-parts cleaning machine



Sharpening tool with Starlite diamond file

Whitney-Jensen slotted brake

Small Bending Brake with Slotted Jaws

A small bending brake with slotted jaws and apron, adapted for rapid economical handling of a number of awkward metal-working operations, is announced by the Whitney Metal Tool Co., Rockford, Ill. This brake is specially designed for bending sheet-metal strips on which one or more bent-up edges or seams have already been formed.

The upper jaw, lower jaw, and apron of this No. 99 Whitney-Jensen 12-inch slotted brake contain matching 3/16-inch slots spaced on 1- and 1/2-inch centers. The slots are 3/4 inch deep in all members and the jaws are 12 inches wide. Thus, the brake can handle any folded up or seamed pieces from 1/2 inch wide up to 11 inches wide, or better, depending on arrangement of the folds.

The brake will bend 20-gage metal of any kind, including stainless steel. The upper jaw is made in the form of an open box to provide adequate stiffness yet allow sufficient space to permit a strip undergoing a series of folds to be laid back closely over the top of the machine.

The brake has an over-all height of 39 inches, requires a floor space of 24 by 29 inches, and weighs only 150 pounds.

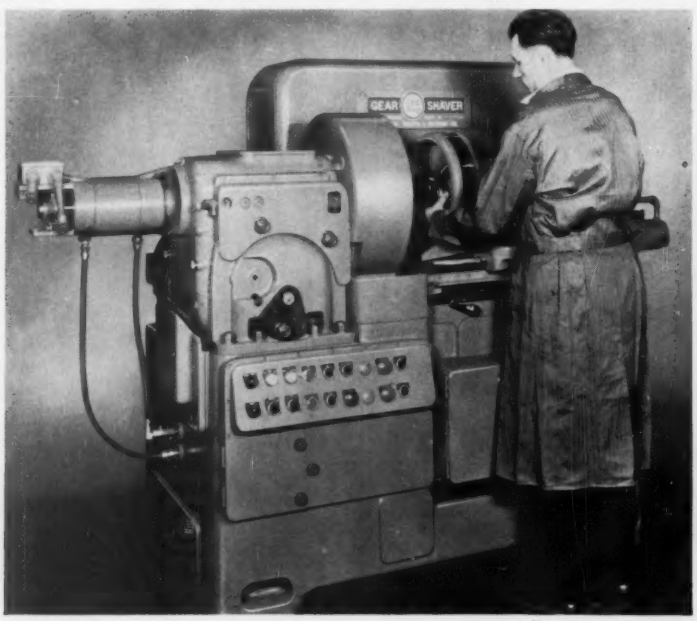
Circle Item 144 on postcard, page 241

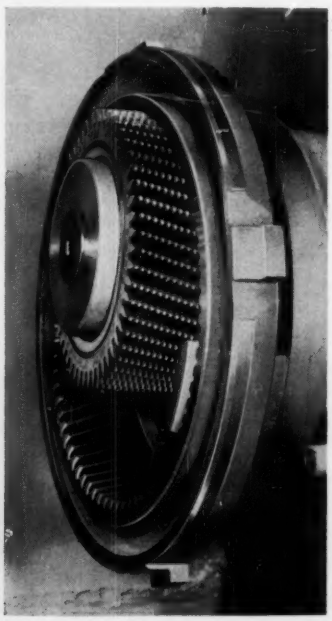
Internal Gear Shaver with Semi-Automatic Loader

An improved Red Ring Model GCR internal gear shaver, Fig. 1, featuring a semi-automatic loader that speeds up loading and unloading operations, is now available from the National Broach & Machine Co., Detroit, Mich. The loader eliminates hand loading and cutter meshing procedures formerly required in shaving internal spur and helical gears. It handles gears having pitch diameters from 3 to 12 inches, teeth up to 4 diametral pitch, and tooth face widths up to 2 1/2 inches. The operator merely hangs the gear to be shaved on the cutter, presses the cycle control and safety buttons, and removes the shaved gear from the work-head.

When the gear is hung on the cutter, Fig. 2, it is located in the correct radial position by a device on the cutter-head. Pressing the cycle start and safety buttons causes the cutter-head to advance and the part to be piloted into the holding fixture in the work-head. Next the part is automatically clamped and the shaving opera-

Fig. 1. (Left) Loading an automotive automatic transmission internal gear on the cutter in the semi-automatic loader of the improved Red Ring internal gear shaver. Fig. 2. (Right) Internal gear in position on the shaving cutter of the machine shown in Fig. 1 before the push-buttons initiate the head advance, clamping, shaving, and unclamping operations





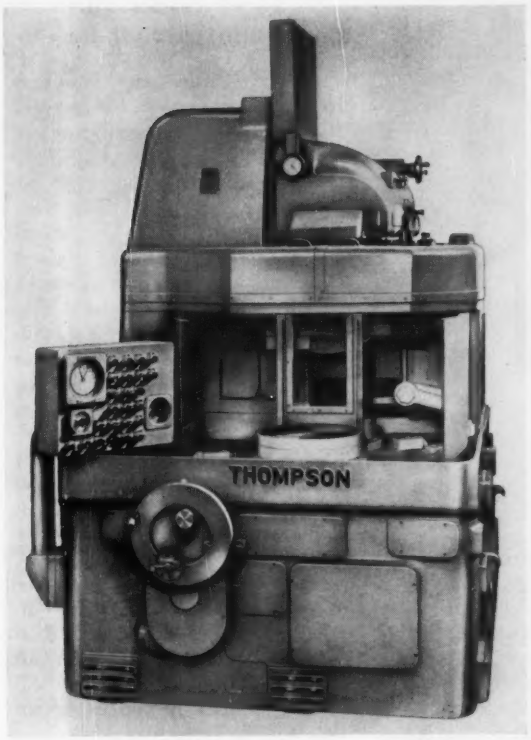


Fig. 1. Twin rotary circular grinder introduced by the Thompson Grinder Co.

Fig. 2. Circular grinding the end face of cluster gear on machine shown in Fig. 1

tion initiated. Following the shaving operation, the cutter-head retracts. The part is then automatically released from the work-holding fixture and ejected.

Circle Item 145 on postcard, page 241

"Firlomet" Cemented Carbide Blanks

Firth-Loach Metals, Inc., McKeesport, Pa., has announced the addition of a new series of "Firlomet" cemented carbide blanks to their line of "laboratory grade" carbides. These include standard reamer, rectangular reamer, and solid square tool blanks.

The standard and rectangular reamer blanks are available in eleven sizes and in two grades. The solid square tool blanks range from 5/32 inch wide, 5/32 inch high, and 1 inch long to 3/8 inch by 3/8 inch by 1 3/4 inches. Cutting edges are hot-ground to an angle of 10 degrees, and the blanks are available in five sizes and in four grades.

Circle Item 146 on postcard, page 241

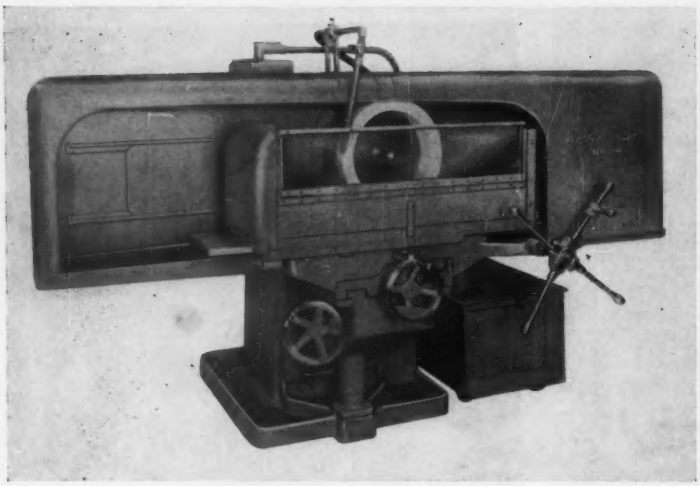
Thompson Twin Rotary Production Grinders

The Thompson Grinder Co., Springfield, Ohio, has announced the completion of a new line of twin rotary circular grinders with table work surfaces from 6 to 24 inches in diameter. With the Type TR twin rotary grinder, Fig 1, the cycle time is said to be reduced 40 per cent because the operator loads one magnetic chuck at the front position while another part is being ground automatically in the rear position.

Typical job applications include grinding automotive gear clusters, aircraft turbo-jet blades, automotive transmission gear faces, circular metal saws, and other intricate parts. The gear cluster illustrated in Fig. 2 is made of SAE 5135 steel. This part is finish-ground to a tolerance of plus or minus 0.0015 inch and a finish of 25 micro-inches r.m.s. From 0.008 to 0.010 inch of stock is removed in this operation.

The automatic machine cycle is started by pressing the proper button. The wheel-head then feeds downward, contacting the work-piece and rapidly and accurately removing a predetermined amount of stock. The spark-out cycle follows, after which the wheel-head returns to the top position and the operator unloads the ground parts. The grinding cycle then starts automatically in the rear position.

The horizontal wheel-head of this machine permits grinding with wheels 14 or 20 inches in diameter. The wheel size is controlled by automatic compensation of the feed-screw. Free loading time enables the operator to arrange other parts or operate other machines. The wheel is dressed automatically by in-position truing according to pre-set machine cycle timing. Accurate finish is assured by the automatic wheel-truing and spark-out methods. Maximum rigidity is obtained with the work-table supported on a large bearing surface. An anti-friction elevating nut assures positive vertical feeding action. Fea-



Face grinder with motorized spindle built by Abrasive Machine Tool Co.

tures also include a variable-speed work-table drive, separate coolant system with extra-large tank, and prelubricated anti-friction ball bearing type centrifugal pump. The automatic gaging unit shown on the grinder illustrated is available as extra equipment.

Circle Item 147 on postcard, page 241

Improved Extensometer for Creep Testing Machine

An electric-contact type extensometer of improved design for automatic control of creep tests at elevated temperatures has been announced by the Baldwin-Lima-Hamilton Corporation, Philadelphia, Pa. This new extensometer is said to increase the operating stability of the creep testing machine. The horizontal contact arm of the extensometer shown at the right in the illustration has been preloaded against a rigid supporting bar to increase contact stability. Instrument stability has also been improved by moving the bottom flexure plate to a lower position. Contacts are made or broken through a worm-gear which is motor-driven by a flexible shaft from the panel of the creep testing machine.

The extensometer has been arranged to follow either extension or contraction of the test specimens. The change from one type of testing to the other is accomplished by means of a two-position toggle switch on the control panel of the machine. This switch is in the circuit of the motor which drives (through a flexible shaft) the worm-gear that makes or breaks the electrical contact as the test specimen elongates or contracts. The motor also drives a counter which indicates the amount of elongation or contraction. Contraction normally occurs when the load is decreased or the temperature is lowered.

Circle Item 148 on postcard, page 241

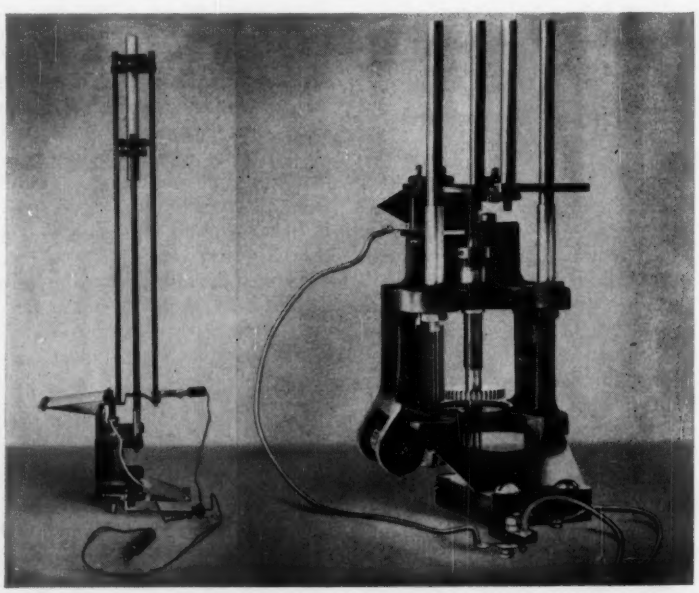
Face Grinder with Motorized Spindle

A face grinder with a motorized spindle, which has an 18-inch cup-shaped grinding wheel mounted perpendicular to the table, has been brought out by the Abrasive Machine Tool Co., East Providence, R. I. The motorized spindle eliminates pulleys and belts and furnishes a simple, exceptionally powerful drive. The machine is equipped with a 15-H.P., heavy-duty motor which has a speed of 900 R.P.M. The box type construction of this grinder is said to provide maximum rigidity for accuracy in grinding any flat or square surface, and also provides large bearing surfaces that have long life and are easy to maintain.

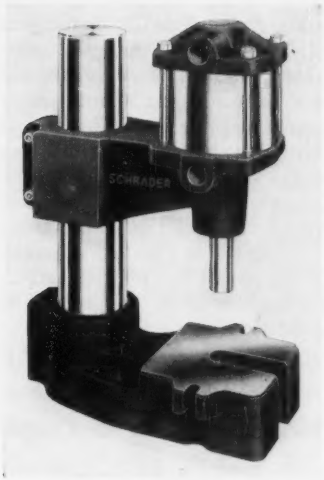
At 900 R.P.M., the abrasive wheel will face-grind cold- or hot-rolled steel, tool steels, steel castings, and all kinds of non-ferrous alloys.

This grinder is applicable for flat, square surface-grinding jobs and is being used to grind automobile dies, plastic molding dies, molded insulated firebrick, ceramic insulators, and all types of forging dies.

Circle Item 149 on postcard, page 241



Improved extensometer, shown at right, which has been brought out by the Baldwin-Lima-Hamilton Corporation for use with its creep testing machine



Schrader air-operated press

Air-Operated Press

An air-operated press with a wide range of speed and performance characteristics is announced by A. Schrader's Son, Division of Scovill Mfg. Co., Inc., Brooklyn, N. Y. This press is designed to perform such operations as stamping, coining, broaching, riveting, staking, pressing, shaping, bending, and assembling. It is available in single-acting impact types and in double-acting squeeze and power withdrawal designs. Control and speed of the heavy-duty cylinder and ram can be varied as required.

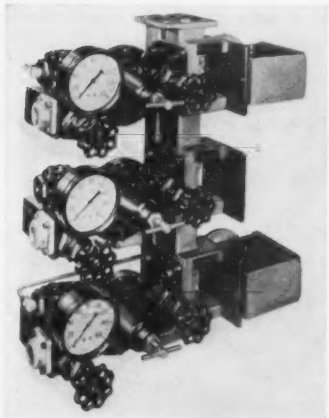
The press is outfitted for two-bolt clamping, which facilitates adjustment for heights from 0 to 7 inches. The swing arc capacity is 2 inches each side of center.

Circle Item 150 on postcard, page 241

Clearing Air Control Manifold for Presses

The Clearing Machine Corporation, Division of U. S. Industries, Inc., Chicago, Ill., has developed an air manifold which provides a simple, efficient means of regulating the air supply to the clutch and brake unit, counterbalance cylinders, and die cushions of large presses. All the valves, regulators, gages, and switches necessary to operate these units have been combined in a single compact unit, eliminating the necessity for assembling this equipment from the various standard parts available.

The components required to regulate a supply of air are grouped into a single composite air valve. These are mounted on a cast housing measuring only 10 inches from end to end. Consequently, no intermediate piping is required between each of the parts. All parts can be serviced without removing the valve. Pressures can be adjusted from 0 to 160 pounds per square inch to suit requirements.



Clearing air control unit for large presses

The headers are furnished in either two- or three-station sizes and are provided with flanges so that larger assemblies or four or more stations can be easily bolted together. Tapped air-line and exhaust ports are provided at both top and bottom of the headers to facilitate installation.

Circle Item 151 on postcard, page 241

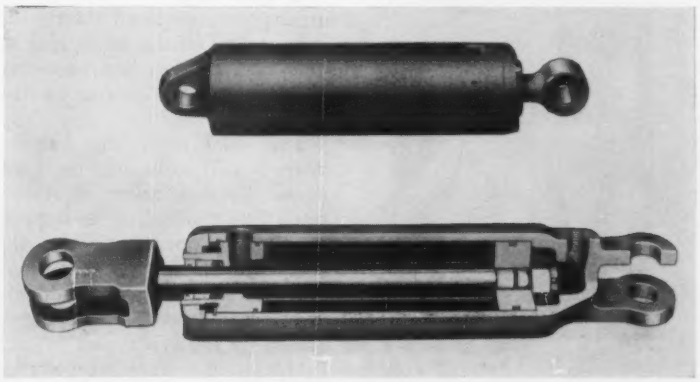
Heavy-Duty Double-Acting Cylinders

The Densmore Engineering Co., Inc., Compton, Calif., has announced a line of heavy-duty, double-acting hydraulic cylinders employing a patented gland design and a method of pre-stressing the snap-ring within the cylinder. These features are said to facilitate maintenance work and assure accurate rod alignment, as well as permit streamline designing of the cylinders.

The piston-rods are heavily chromium-plated, and the pistons are made of aluminum to prevent corrosion and scoring. V-ring rod packings are independently adjustable, and the bronze wiper ring on the piston-rod is used to prevent foreign material from entering the cylinder. The cylinders are of honed seamless steel tubing with welded cast-steel clevises. The clevises are designed to prevent cylinder distortion during welding.

These cylinders are available in sizes having bores that range from 2 1/2 through 4 inches in diameter and with strokes from 1 inch through 18 feet. They are designed for operation at pressures up to 1500 pounds per square inch and meet with SAE standards for hydraulic cylinders.

Circle Item 152 on postcard, page 241



Densmore heavy-duty, double-acting hydraulic cylinders with patented gland design

Fig. 1. Direct-current "Bumblebee" arc-welder

Arc-Welding Machines

Three new arc-welding machines are now available from the Air Reduction Sales Co., a Division of Air Reduction Co., Inc., New York City. The direct-current "Bumblebee" arc-welder, Fig 1, has improved selenium rectifiers designed to convert alternating current to direct current. This welder is available in 200-, 300-, and 400-ampere models.

The new metallic arc-welding machine, not shown, will supply either alternating or direct current by the flick of a switch. A patented control circuit eliminates the need for any mechanical type control. This machine also is available in 200-, 300-, and 400-ampere models, with or without power factor correction.

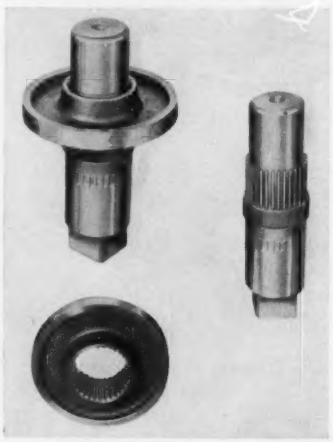
The alternating- and direct-current Heliwelder, Fig. 2, is available in 200- and 300-ampere models. This welder is for use with the various inert-gas arc-welding processes in addition to metallic arc-welding. A flick of the switch converts these machines from inert-gas welding to metallic arc-welding.

Circle Item 153 on postcard, page 241

Fig. 2. Alternating- or direct-current Heliwelder

Pin Type Arbor for Holding Gears with Involute Splined Bores

Precision machining of gears with involute splined bores is said to be greatly facilitated by the use of a new pin type arbor developed by Scully-Jones & Co., Chicago, Ill. This arbor provides a rapid method of loading, locking, and unloading work-pieces. No arbor press is required to force the gear on and off the arbor, and no nuts or wrenches are necessary for locking work-pieces on the arbor.



Scully-Jones pin type arbors for holding gears with involute splined bores

The quality of the finished gears is said to be improved because the new arbor eliminates pitch line run-out in subsequent gear-cutting operations. Also, the face and sides of the gear blank will run square and true due to the powerful precision hold generated by the arbor pins.

Operation of the pin type arbor is extremely easy. The work-piece is simply loaded on the arbor and rotated to actuate the clamping or holding pins. This causes the pins to move up on internal cams which force the pins into line contact with adjacent splines at, or near, the pitch line. The part is thus locked firmly to the arbor as the pins apply equal force all around the splined bore. Thrust from turning and grinding operations serves to prevent loosening of the piece. The pin type arbors are made to order for turning and grinding operations.

Circle Item 154 on postcard, page 241

Weighing Scales for Cranes

Hydroway Scales, Inc., Detroit, Mich., has announced an expansion in its line of "Hydroscale" weighing scales, which now includes 110 models with capacities from 500 to 200,000 pounds. Thus there is a model to meet almost any industrial weighing requirement and to suit every crane application. The largest and smallest "Hydroscales" in the line are shown in the illustration.

All models are provided with tare-adjusting knobs so that the net load reading can be readily obtained. The easy-to-read dials are available in three sizes, the largest being 30 inches in diameter. All dials are printed plainly, black on white, in Gothic characters. Tempered dial safety glass equal in impact resistance to plate glass 1 1/2 inches thick protects the dial surface.

Circle Item 155 on postcard, page 241

Largest and smallest "Hydroscales" for Hydroway cranes

(This section continued on page 226)

Today's Most Profitable Grinder for Toolrooms!

• *most versatile* • *most flexible* • *most economical*

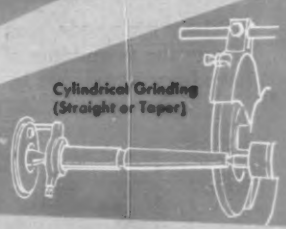
You can really step up economy in toolroom grinding with the Brown & Sharpe No. 13 Universal and Tool Grinding Machine! Most versatile high precision grinder on the market. Easiest to set up and operate. Assures highest productivity on the widest range of grinding operations. Outstanding features: *Wheel Spindle* has convenient "eye level" vertical adjustment, easy transverse adjustments, quick horizontal angular settings. *Headstock* allows precise angular settings in the horizontal plane. *Table* is swivel-mounted with setting by scale to 90° each side of zero. Broad selection of work, wheel, and table speeds. Plenty of power with no sacrifice of control sensitivity. Available with a wide variety of attachments to further broaden grinding applications. Write for full details. Brown & Sharpe Mfg. Co., Providence, R. I.

B·S

Brown & Sharpe

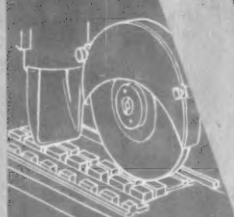
Ask About Our
Pay-As-You Depreciate
Machine Tool Plan

Internal Grinding



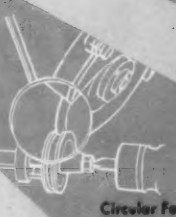
Cylindrical Grinding
(Straight or Taper)

Face Grinding

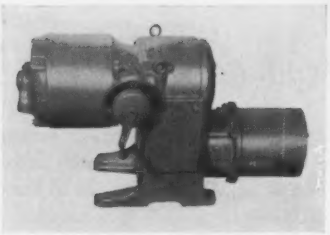


Surface Grinding

Radius Cutter Grinding



Circular Form Tool Grinding



"Varidyne" power unit developed by U. S. Electrical Motors, Inc.

"Varidyne" Power Units

A "Varidyne" synchronized, variable-speed, multiple-drive system, developed by U. S. Electrical Motors, Inc., Los Angeles, Calif., has a power unit in which the speed of each motor in the system is varied equally and simultaneously by electrical impulses. An alternating-current squirrel-cage induction type motor is connected to the power unit by means of a standard three-phase circuit. Speeds of from 1 to 10,000 R.P.M. are available in ratios up to 5 to 1. "Varidyne" motor types from 1/3 to 25 H.P. and power units in load-carrying capacities of 1 to 50 H.P. are available.

Circle Item 156 on postcard, page 241

Producto "Qwik-Fit" Guide Pins for Dies

"Qwik-Fit" guide pins that facilitate the assembling of die sets have been introduced by the Producto Machine Co., Bridgeport, Conn. These guide pins, shown in Fig. 1, feature a combination spherical and angular formed end that makes it impossible for the die set to become cocked or jammed. A Producto die set provided with "Qwik-Fit" pins, as illustrated in Fig. 2, enables the die-maker to easily start the punch holder on the die in accurate alignment with the pins, but should it be started at an angle, the die set will align itself.

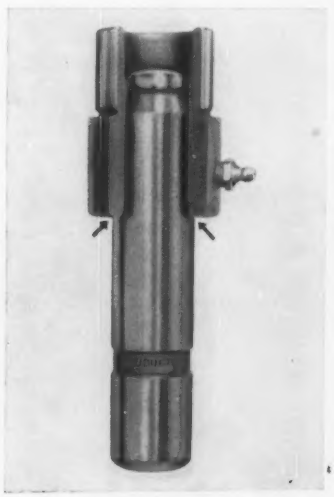


Fig. 1. "Qwik-Fit" guide pin

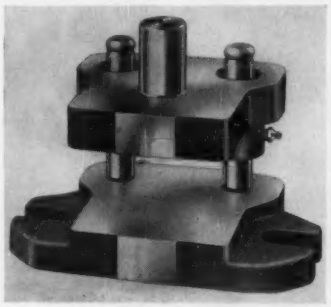


Fig. 2. Producto die set equipped with "Qwik-Fit" guide pins

Circle Item 157 on postcard, page 241

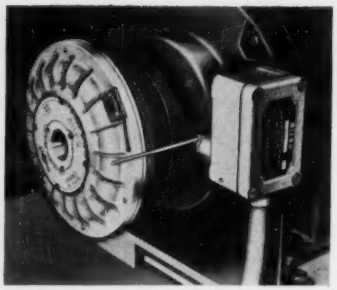
Raybestos Tool with Bonded Ceramic Tip

A revolutionary type ceramic-tipped cutting tool is being introduced to the metalworking industry by the Raybestos Division, Raybestos-Manhattan, Inc., Bridgeport, Conn., and will be marketed under the trade name "Keramik." The ceramic tip of the tool is bonded to a steel shank. These tools are now available in a standard size 1/2 by 1/2 by 3 1/2 inches (BR-8-M and BL-8-M) with a lead angle of 7 degrees. When properly ground, these tools produce a fine finish.

Circle Item 158 on postcard, page 241

Cutout that Protects Drive Against Overload

The "Flexidyne" dry fluid drive made by the Dodge Mfg. Corporation, Mishawaka, Ind., can now be protected against overloading by a thermal cutout. If an overload causes prolonged slipping and consequent heating of the



Dodge "Flexidyne" drive equipped with thermal overload cutout

"Flexidyne" drive, the thermal cutout trips a switch that cuts off the power and, if desired, gives an alarm. The device can easily be mounted on the side of the drive. It contains a trigger spring held down by an alloy thermal pin. Before the drive can heat up enough to cause any damage, the thermal pin will melt, allowing the trigger to spring out so that it will push the nonsparking striker of the special switch to the "off" position. It is an easy matter to reset the unit, simply by removing one screw, pushing back the trigger, and inserting a new thermal pin.

Circle Item 159 on postcard, page 241

Core-Drills with Three and Four Flutes

Whitman & Barnes, Plymouth, Mich., is offering a series of three- and four-flute core-drills which

Whitman & Barnes core-drills

(Continued on page 228)

Square locked head maintains ACCURATE alignment

Box section arm fully encloses driving shaft

100% Anti-friction bearings

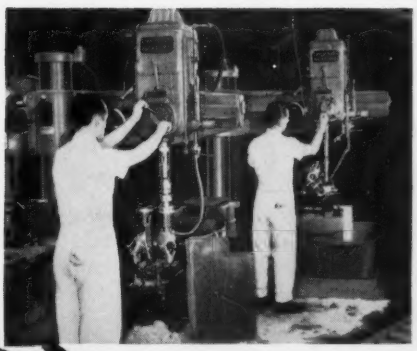
Head in perfect balance on arm

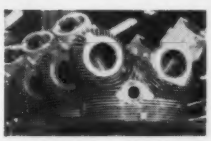
Arm swings with finger tip ease

No driving clutches

LONG LIVED ACCURACY

in this high speed Super Service Radial!





Drilling, Core Drilling and Reaming Alloy Steel Cheek and Counterweights of Aircraft Engine Crankshafts. Reamed holes are held accurate within .0005".

3 and 4 foot arm.

Spindle speeds up to 3500 r.p.m. without belts.

This simplified, very versatile, speedy, accurate and durable machine is rigid and easy to handle.

A distinctive feature is the elimination of spindle driving clutches as forward and reverse rotation is thru a reversing motor . . . very fast for tapping work.

Furnished with 9″ column with 3′ or 4′ arm and 3 HP driving motor.

Get the details. In their range, these machines are most economical and productive.

Write for Bulletin R-21C.

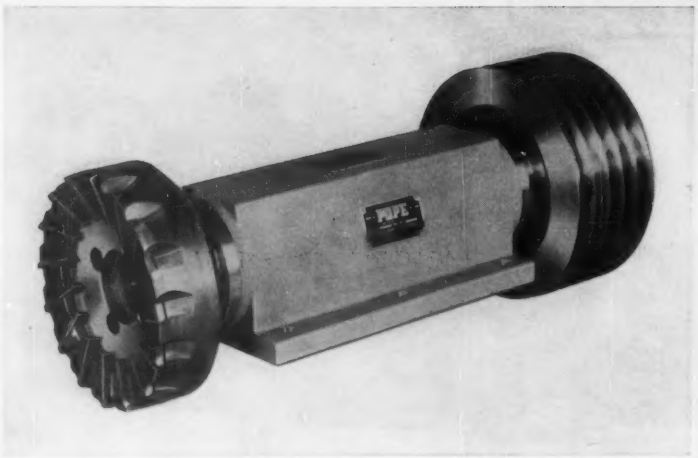
CINCINNATI BICKFORD

RADIAL AND UPRIGHT DRILLING MACHINES

CINCINNATI BICKFORD DIVISION

GIDDINGS & LEWIS MACHINE TOOL COMPANY

OAKLEY, CINCINNATI 9, OHIO, U.S.A.



Pope heavy-duty milling spindle

are so constructed that the center portion of the drill does not cut. These drills are specifically designed for the enlarging of holes. They are said to facilitate the use of faster feeds and to produce smoother, more accurate finishes.

These three- and four-flute type core-drills are furnished with straight or taper shanks. Sizes range from 1/4 inch to 3 inches in taper shank style and from 1/4 inch to 2 inches in straight shank style.

Circle Item 160 on postcard, page 241

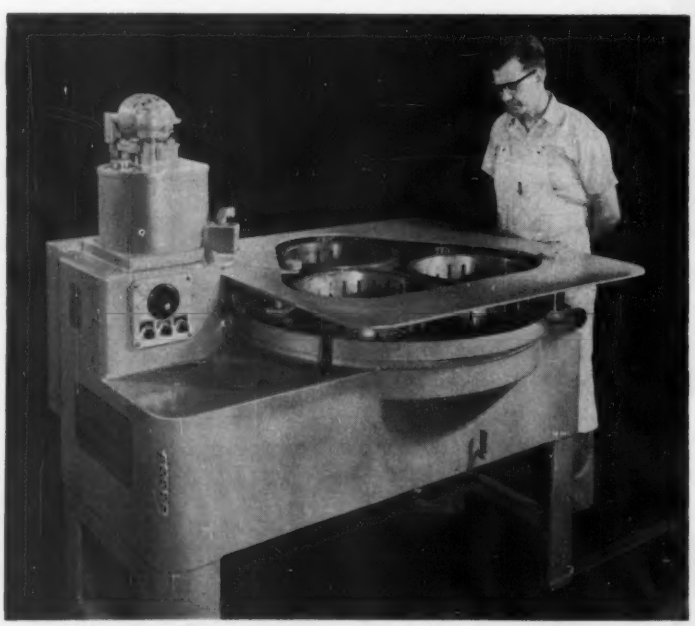
Heavy-Duty Milling Spindles

A new line of heavy-duty belt-driven milling spindles is announced by the Pope Machinery Corporation, Haverhill, Mass. These precision spindles are available in a range of sizes from 1 to 50 H.P. with standard No. 10, 20, 30, 40, 50, or 60 milling machine noses.

Noteworthy features of these milling spindles are the bearings with which they are equipped. Two large cylindrical roller bearings carry the radial loads. Their bores are tapered, as are the massive shafts in these spindles, so that the bearings may be individually preloaded. A pair of precision thrust bearings is likewise permanently preloaded to stabilize the shaft axially against endwise movement in either direction.

The bearings are lubricated for their entire operating life, and the spindles run at low temperatures that are scarcely warmer than the hand. These milling spindles can be arranged to operate in any position the user specifies. They are also available with totally enclosed, fan-cooled motor drives from 1 to 100 H.P.

Circle Item 161 on postcard, page 241



Recent addition to "John Crane" line of Lapmaster machines announced by the Crane Packing Co.

Large Capacity Precision Lapping Machine

A 36-inch lapping machine is now available from the Crane Packing Co., Morton Grove, Ill. This machine is part of the "John Crane" line of Lapmasters having lapping plate diameters ranging from 12 to 72 inches.

The conditioning rings of the new machine are 14 1/2 inches in diameter, thus permitting handling parts up to that size. The 36-inch machine will take well over twice as many 1-inch parts as the 24-inch model. The drain hole is on the side, and a wiper blade is fastened to the under side of the base table to bring all of the spent compound into the drain. A rubber hose, fastened to the drain plug, leads to a container placed under the machine.

The Lapmaster lapping machines are capable of generating surface flatness to less than one light band and finishes to 2 microinches r.m.s. in short or high-production runs. They are widely used for lapping parts for adding machines, engines, transmissions, cameras and projectors, tool and die equipment, and quartz and germanium crystals. Materials that can be lapped include Monel, steel, Stellite, brass, aluminum, glass, carbon, plastics, and ceramics.

Circle Item 162 on postcard, page 241

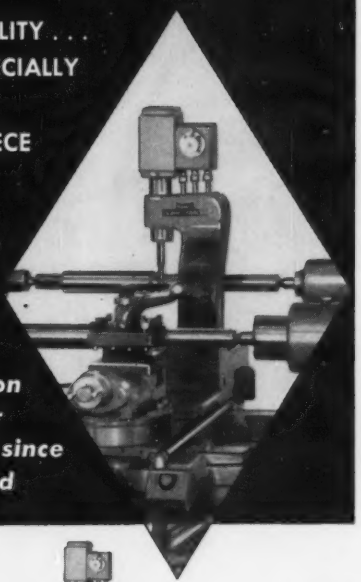
(This section continued on page 234)

Truly Sensational!!

IN SIMPLICITY . . . VERSATILITY . . .
PRECISION-ACCURACY . . . ESPECIALLY
IN SAVINGS IN COST
PER FINISHED PIECE

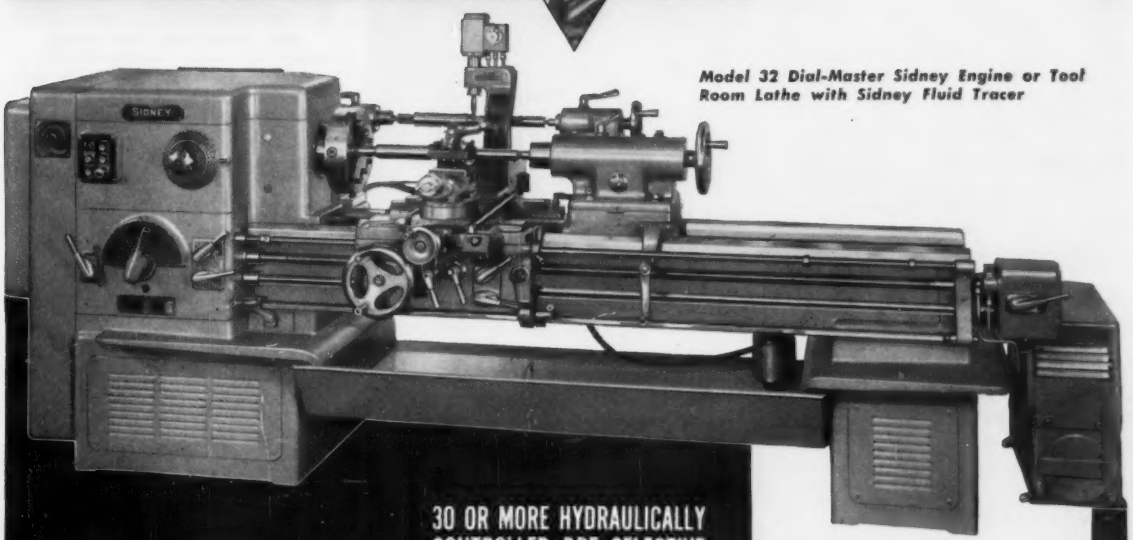
SIDNEY
FLUID TRACER

The finest precision duplicating attachment ever offered to industry since cutting tools were invented



INSTANTLY . . . precisely and in any desired quantity (no matter how small or extended a run) every change in contour is transferred from master piece or template to the cutting tool. It also controls the hydraulically actuated cross feed and the longitudinal movement of the carriage.

Changeover to standard lathe operation or back to tracer work requires only a few seconds without the addition or removal of any parts.



Model 32 Dial-Master Sidney Engine or Tool Room Lathe with Sidney Fluid Tracer

THE SIDNEY MACHINE TOOL COMPANY
over 50 years
of service to
AMERICAN INDUSTRY
SIDNEY · OHIO

30 OR MORE HYDRAULICALLY CONTROLLED PRE-SELECTIVE SPINDLE SPEEDS

A revolutionary innovation and presented as a "SIDNEY FIRST" as long ago as the Machine Tool Show of 1947 . . . used regularly as a standard SIDNEY feature ever since. But only recently adapted by other lathe manufacturers . . . a fitting tribute to SIDNEY pioneering and leadership.

THE SIDNEY FLUID TRACER is remarkable! It saves time and costs and increases production.

Write for bulletin or ask for representative to call at your convenience.

THE SIDNEY MACHINE TOOL CO. • SIDNEY, OHIO

Builders of Precision Machinery since 1904

surest thing in measuring—

There's never an argument when it comes to precision measuring tools. Just specify STARRETT and you'll please everyone in the shop — from the tool crib supervisor to the rawest apprentice.

But why stop with measuring tools when there are so many opportunities to get the same quality and dependability in so many other Starrett products? Did you know, for example, that Starrett makes the world's most complete line of dial indicators and dial gages? Or that Starrett is among the largest producers of hacksaws, hole saws, band saws and band knives? Or that Starrett makes precision ground die and flat stock in over 1000 sizes?

Your Industrial Supply Distributor stocks the complete Starrett line. He can give you prompt, dependable service to match the quality and dependability of Starrett products. It pays in so many ways to specify *Starrett.*

NEW CATALOG No. 27

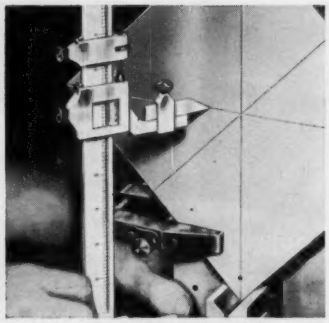
Shows the complete Starrett line. Ask your Industrial Supply Distributor or write for free copy. Address Dept. D, The L. S. Starrett Company, Athol, Massachusetts, U. S. A.

Starrett

Buy through your INDUSTRIAL DISTRIBUTOR — Prompt delivery, dependable service, Quality products

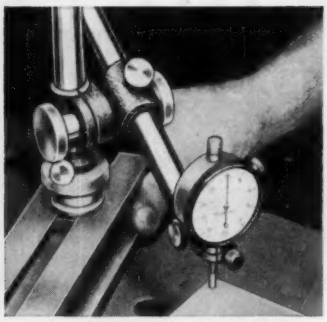
SINCE 1880
WORLD'S GREATEST TOOLMAKERS

MECHANICS' HAND MEASURING TOOLS AND PRECISION INSTRUMENTS
DIAL INDICATORS • STEEL TAPES • PRECISION GROUND FLAT STOCK
HACKSAWS • HOLE SAWS • BAND SAWS • BAND KNIVES



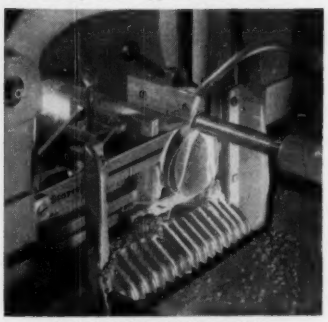
HAND MEASURING TOOLS AND PRECISION INSTRUMENTS

The name Starrett on a tool guaran'ees accuracy, fine workmanship and complete dependability.



DIAL INDICATORS AND GAGES

Standard for quality and dependability—a complete line for every gaging or production inspection application.



HACKSAWS, BAND SAWS, BAND KNIVES

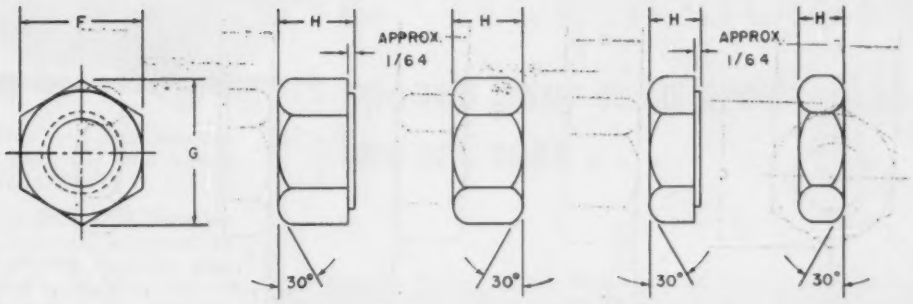
Precision made and production proved for top performance, uniformity and maximum cutting economy.

PRECISION GROUND DIE STOCK AND FLAT STOCK

Now over 1000 sizes — air, oil, oil and water and water hardening types. "Just lay it out and saw it out."

For more information fill in page number on Inquiry Card, on page 247

AMERICAN STANDARD FINISHED HEXAGON AND HEXAGON-JAM NUTS



Nominal Size or Basic Major Diameter of Thread		Width Across Flats F			Width Across Corners G		Thickness Nuts H			Thickness Jam Nuts H		
		Max.	(Basic)	Min.	Max.	Min.	Nom.	Max.	Min.	Nom.	Max.	Min.
1/4	**0.2500**	**7/16**	**0.4375**	**0.428**	**0.505**	**0.488**	**7/32**	**0.226**	**0.212**	**5/32**	**0.163**	**0.150**
5/16	**0.3125**	**1/2**	**0.5000**	**0.489**	**0.577**	**0.557**	**17/64**	**0.273**	**0.258**	**3/16**	**0.195**	**0.180**
3/8	**0.3750**	**9/16**	**0.5625**	**0.551**	**0.650**	**0.628**	**21/64**	**0.337**	**0.320**	**7/32**	**0.227**	**0.210**
7/16	**0.4375**	**11/16**	**0.6875**	**0.675**	**0.794**	**0.768**	**3/8**	**0.385**	**0.365**	**1/4**	**0.260**	**0.240**
1/2	**0.5000**	**3/4**	**0.7500**	**0.736**	**0.866**	**0.840**	**7/16**	**0.448**	**0.427**	**5/16**	**0.323**	**0.302**
9/16	**0.5625**	**7/8**	**0.8750**	**0.861**	**1.010**	**0.982**	**31/64**	**0.496**	**0.473**	**5/16**	**0.324**	**0.301**
5/8	**0.6250**	**15/16**	**0.9375**	**0.922**	**1.083**	**1.051**	**35/64**	**0.559**	**0.535**	**3/8**	**0.387**	**0.363**
3/4	**0.7500**	**1 1/8**	**1.1250**	**1.088**	**1.299**	**1.240**	**41/64**	**0.665**	**0.617**	**27/64**	**0.446**	**0.398**
7/8	**0.8750**	**1 5/16**	**1.3125**	**1.269**	**1.516**	**1.447**	**3/4**	**0.776**	**0.724**	**31/64**	**0.510**	**0.458**
1	**1.0000**	**1 1/2**	**1.5000**	**1.450**	**1.732**	**1.653**	**55/64**	**0.887**	**0.831**	**35/64**	**0.575**	**0.519**
1 1/8	1.1250	1 11/16	1.6875	1.631	1.949	1.859	31/32	0.999	0.939	39/64	0.639	0.579
1 1/4	1.2500	1 7/8	1.8750	1.812	2.165	2.066	1 1/16	1.094	1.030	23/32	0.751	0.687
1 3/8	1.3750	2 1/16	2.0625	1.994	2.382	2.273	1 11/64	1.206	1.138	25/32	0.815	0.747
1 1/2	1.5000	2 1/4	2.2500	2.175	2.598	2.480	1 9/32	1.317	1.245	27/32	0.880	0.808
1 3/4	1.7500	2 5/8	2.6250	2.538	3.031	2.893	1 1/2	1.540	1.460	31/32	1.009	0.929
2	2.0000	3		3.0000	2.900	3.464	3.306	1 23/32	1.763	1.675	1 3/32	1.138	1.050
2 1/4	2.2500	3 3/8		3.3750	3.262	3.897	3.719	1 59/64	1.970	1.874	1 13/64	1.251	1.155
2 1/2	2.5000	3 3/4		3.7500	3.625	4.330	4.133	2 9/64	2.193	2.089	1 29/64	1.505	1.401
2 3/4	2.7500	4 1/8		4.1250	3.988	4.763	4.546	2 23/64	2.415	2.303	1 37/64	1.634	1.522
3	3.0000	4 1/2		4.5000	4.350	5.196	4.959	2 37/64	2.638	2.518	1 45/64	1.763	1.643

All dimensions given in inches.

BOLD TYPE indicates products unified dimensionally with British and Canadian Standards.

"Finished" in the title refers to the quality of manufacture and the closeness of tolerance and does not indicate that surfaces are completely machined.

Taper of the sides of nuts (angle between one side and the axis) shall not exceed 2 degrees, the specified width across flats being the largest dimension.

Tops of nuts shall be flat and chamfered. Diameter of top circle shall be the maximum width across flats within a tolerance of minus 15 per cent for washer-faced nuts and within a tolerance of minus 5 per cent for double-chamfered nuts.

Bearing surface shall be washer-faced or have chamfered corners. Diameter of circle of bearing surface shall be the maximum width across flats within a tolerance of minus 5 per cent. Tapped hole shall be countersunk 1/64 inch over the major diameter of thread for nuts up to and including 1/2 inch, and countersunk 1/32 inch over the major diameter of thread for nuts over 1/2-inch size.

Bearing surface shall be at right angles to the axis of the threaded hole within a tolerance of 2 degrees for 5/8-inch nuts or smaller, and 1 degree for nuts larger than 5/8 inch; therefore, the maximum total run-out of bearing face would be equal to the tangent of the specified angle times the distance across flats.

Thread shall be coarse-, fine-, or 8-thread series; Class 2B tolerance.

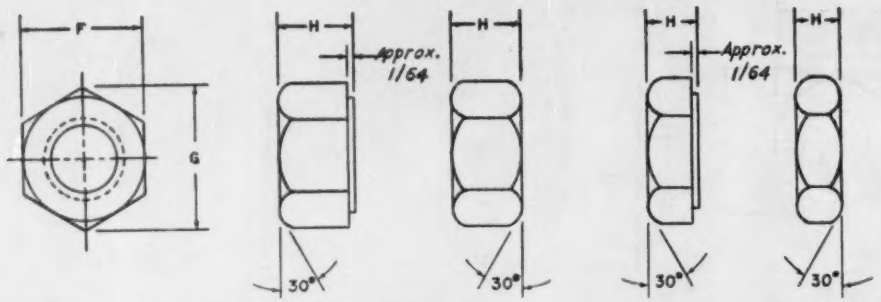
Suitable material for steel nuts is covered by ASTM A-307; other materials will be as agreed upon by manufacturer and user.

Tolerance on width across flats may be increased 0.015 inch for hot-formed nuts 5/8 inch and smaller.

Extracted from American Standard Square and Hexagon Bolts and Nuts (ASA B18.2-1955), with the permission of the publisher, the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

AMERICAN STANDARD REGULAR SEMIFINISHED HEXAGON AND HEXAGON-JAM NUTS

1/4- to 5/8-inch sizes not recommended for new designs.*



Nominal Size or Basic Major Diameter of Thread	Width Across Flats F			Width Across Corners G		Thickness Regular Nuts H			Thickness Regular Jam Nuts H		
	Max. (Basic)		Min.	Max.	Min.	Nom.	Max.	Min.	Nom.	Max.	Min.
1/4 0.2500	7/16	0.4375	0.425	0.505	0.485	13/64	0.219	0.187	9/64	0.157	0.125
5/16 0.3125	9/16	0.5625	0.547	0.650	0.624	1/4	0.267	0.233	11/64	0.189	0.155
3/8 0.3750	5/8	0.6250	0.606	0.722	0.691	5/16	0.330	0.294	13/64	0.221	0.185
7/16 0.4375	3/4	0.7500	0.728	0.866	0.830	23/64	0.378	0.340	15/64	0.253	0.215
1/2 0.5000	13/16	0.8125	0.788	0.938	0.898	27/64	0.442	0.402	19/64	0.317	0.277
9/16 0.5625	7/8	0.8750	0.847	1.010	0.966	31/64	0.505	0.463	21/64	0.349	0.307
5/8 0.6250	1	1.0000	0.969	1.155	1.104	17/32	0.553	0.509	23/64	0.381	0.337
Below this line, dimensions are in accord with Finished Hexagon and Hexagon-Jam Nuts											
3/4 0.7500	1 1/8	1.1250	1.088	1.299	1.240	41/64	0.665	0.617	27/64	0.446	0.398
7/8 0.8750	1 5/16	1.3125	1.269	1.516	1.447	3/4	0.776	0.724	31/64	0.510	0.458
1 1.0000	1 1/2	1.5000	1.450	1.732	1.653	55/64	0.887	0.831	35/64	0.575	0.519
1 1/8 1.1250	1 11/16	1.6875	1.631	1.949	1.859	31/32	0.999	0.939	39/64	0.639	0.579
1 1/4 1.2500	1 7/8	1.8750	1.812	2.165	2.066	1 1/16	1.094	1.030	23/32	0.751	0.687
1 3/8 1.3750	2 1/16	2.0625	1.994	2.382	2.273	1 11/64	1.206	1.138	25/32	0.815	0.747
1 1/2 1.5000	2 1/4	2.2500	2.175	2.598	2.480	1 9/32	1.317	1.245	27/32	0.880	0.808
1 5/8 1.6250	2 7/16	2.4375	2.356	2.815	2.686	1 25/64	1.429	1.353	29/32	0.944	0.868
1 3/4 1.7500	2 5/8	2.6250	2.538	3.031	2.893	1 1/2	1.540	1.460	31/32	1.009	0.929
1 7/8 1.8750	2 13/16	2.8125	2.719	3.248	3.100	1 39/64	1.651	1.567	1 1/32	1.073	0.989
2 2.0000	3	3.0000	2.900	3.464	3.306	1 23/32	1.763	1.675	1 3/32	1.138	1.050
2 1/4 2.2500	3 3/8	3.3750	3.262	3.897	3.719	1 59/64	1.970	1.874	1 13/64	1.251	1.155
2 1/2 2.5000	3 3/4	3.7500	3.625	4.330	4.133	2 9/64	2.193	2.089	1 29/64	1.505	1.401
2 3/4 2.7500	4 1/8	4.1250	3.988	4.763	4.546	2 23/64	2.415	2.303	1 37/64	1.634	1.522
3 3.0000	4 1/2	4.5000	4.350	5.196	4.959	2 37/64	2.638	2.518	1 45/64	1.763	1.643

* This table is published for interim use during the change-over to the new standard on preceding page until such time as complete conversion can be made.

All dimensions given in inches.

Semifinished nuts are finished on bearing surface and threaded.

Taper of the sides of nuts (angle between one side and the axis) shall not exceed 2 degrees, the specified width across flats being the largest dimension.

Tops of nuts shall be flat and chamfered. Diameter of top circle shall be the maximum width across flats within a tolerance of minus 15 per cent.

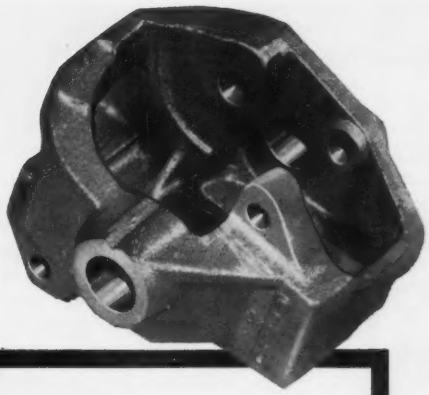
Bearing surface shall be washer-faced or have chamfered corners. Diameter of washer face and the diameter of circle of bearing surface of double-chamfered nuts shall be the maximum width across flats within a tolerance of minus 5 per cent.

Bearing surface shall be at right angles to the axis of the threaded hole within a tolerance of 2 degrees for 5/8-inch nuts or smaller, and 1 degree for nuts larger than 5/8 inch; therefore, the maximum total run-out of bearing face would be equal to the tangent of the specified angle times the distance across flats.

Thread may be coarse-, fine-, or 8-thread series, Class 2B tolerance; unless otherwise specified, coarse-thread series will be furnished.

Suitable material for steel nuts is covered by ASTM A-307; other materials will be as agreed upon by manufacturer and user.

Extracted from American Standard Square and Hexagon Bolts and Nuts (ASA B18.2-1955), with the permission of the publisher, the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.



New Ex-Cell-O 2-Way Machine

speeds gear case production, lowers cost . . .

ABOVE: Gear case after machining. Hole sizes are held within .0005″, centers .001″.

BELOW: New Style 54-A Precision Two-Way Machine equipped to bore and chamfer cast-iron gear cases. Except for loading, clamping and unloading, this machine is entirely automatic.

Typical of Ex-Cell-O's constant improvement in the field of precision production is this new Style 54-A Two-Way Precision Boring Machine.

Operations on the cast-iron gear case illustrated include finish boring seven holes and chamfering diameters at two points. With its new hydraulic control panel each way unit has a greater range of feeds and a higher rate of rapid traverse.

Like all standard Ex-Cell-O Machines, the new 54-A is easily adapted at slight cost to a variety of precision setups. For further information, contact the Ex-Cell-O representative in your area, or write, wire or phone direct to Ex-Cell-O, Detroit.

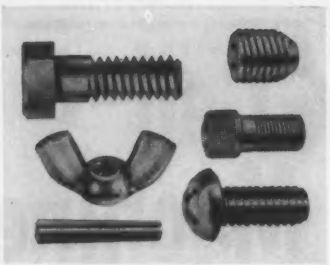
EX-CELL-O

CORPORATION

DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

86-25



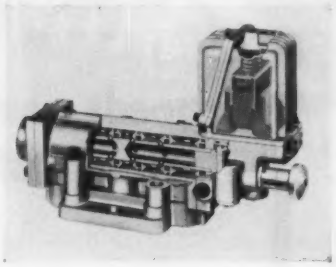
Star Stainless-Steel Fastenings

Stainless-steel fastenings, formerly available only as "specials," are now standard items for immediate delivery from Star Stainless Screw Co., Paterson, N. J. These items include dowel-pins, taper pins, wing-nuts, acorn nuts, large hex-head bolts (1 inch in diameter and up), 18-8 Phillips sheet-metal screws and machine screws, 0-80 and 1-72 socket set- and cap-screws.

Circle Item 163 on postcard, page 241

"Quick-As-Wink" Control Valve

"B" type "Quick-As-Wink" air and hydraulic control valve of line introduced by C. B. Hunt & Son, Inc., Salem, Ohio. The chambers



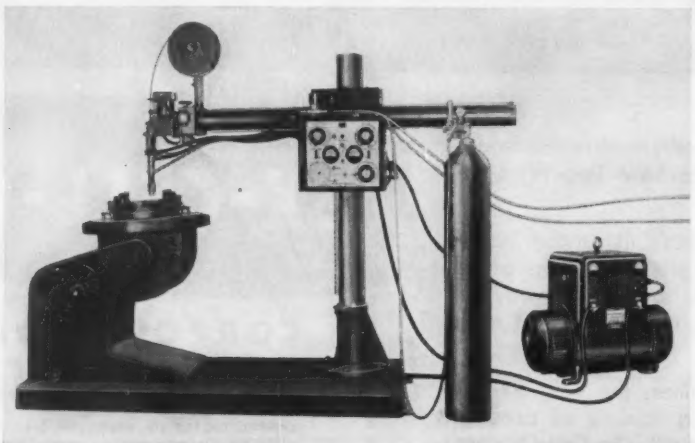
in the valves of this new line (see cut-away view) are formed by aluminum spacers held in accurate end-to-end metal contact. This arrangement simplifies internal construction and permits the O-rings or U-packers to be supported on both the inside and outside diameters without subjecting them to mechanical pressure. It also facilitates quick servicing in the field, if necessary. There is no need to return the valves to the factory for servicing, or even to carry large inventories of standby valves or parts. The hollow, radially ported, stainless-steel, ground and polished plunger is the only moving part except the operating mechanism.

Circle Item 165 on postcard, page 241

Automatic Welding Unit

Automatic consumable-electrode welding unit designed by Hobart Brothers Co., Troy, Ohio, for use with their "Powromatic" constant-voltage welder. This inert-gas shielded-arc welding unit can be mounted on a stationary fixture with the work traveling, or on a traveling fixture with the work in a stationary position. Two models are available. Model AIG-4D is a dual-control type complete with a double-swing welding head, gas and water supply facilities, dual-control panel, wire reel, and spool adapter. Model AIG-4T is a triple-control type with an additional travel motor speed control. Argon, helium, or carbon dioxide may be used as the shield gas. Either of these models can be employed with hard wire 0.035 to 1/8 inch in diameter or soft wire from 0.045 to 3/32 inch in diameter.

Circle Item 164 on postcard, page 241



Air-Driven Hot Salt Pump

A pump designed especially for pumping molten salts and hot metals, powered by an air-driven motor which is self-cooling, has been announced by Ajax Electric Co., Inc., Philadelphia, Pa. The pump body has a limited number of sturdy parts and is designed for operation under high ambient temperatures. The pump is available in steel or with stainless-steel submerged parts (for temperatures over 1000 degrees F.). It has a maximum flow capacity of 36,000 pounds an hour when driven by compressed air at a pressure of 90 pounds per square inch. The volume can be reduced as desired by means of an air intake valve.

Circle Item 166 on postcard, page 241

(This section continued on page 238)

PRODUCTION SHORT CUTS WITH

ZINC DIE CASTINGS

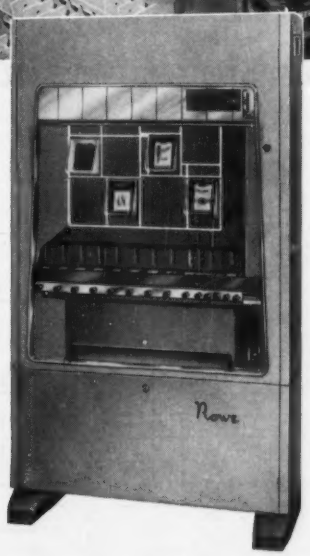
NUMBER 3 OF A SERIES

MAKING THE SALE FOR .... Rowe®

When you make a purchase from the familiar Rowe Ambassador cigarette machine, the coins are handled almost completely by a series of intricately shaped ZINC Die Castings. A die cast plunger then delivers the package you select. The efficiency with which this mechanical business transaction takes place is the result of expert engineering which has made Rowe "America's First Automatic Merchandising Family."

These are the outstanding production advantages provided by the use of ZINC Die Castings for the vital cigarette machine components:

1. Avoidance of expensive machining—the castings are virtually ready for assembly as received from the die caster.
2. Minimizing of assembly operations—unusual complexity of shape makes one part serve in place of several if produced by other means.
3. Assurance of trouble-free operation through sturdy construction and close dimensional control of all castings in long production runs.
4. Ability to take and hold economical and attractive plated coatings (external castings only, internal parts are used "as is").



The continuous use of ZINC Die Castings by Rowe Manufacturing Company, Inc. through many machine design improvements, over a long period of years, is a tribute to the fine performance of such parts under rough everyday operation. For possible answers to *your* production problems through the use of ZINC Die Castings, send for our brochure and contact any commercial die casting company.

Send for your copy

ZINC
FOR DIE CASTING ALLOYS

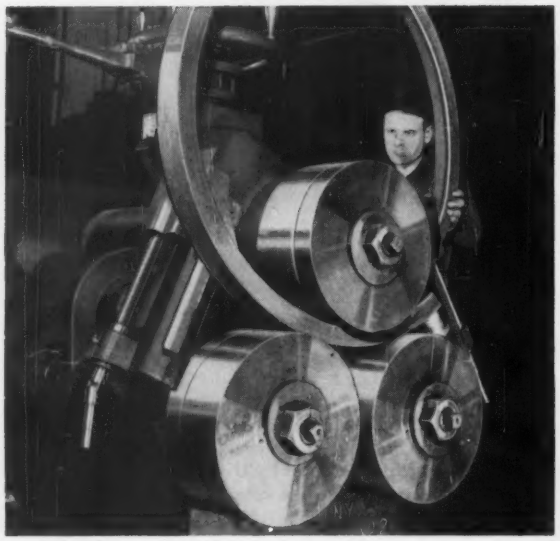
The New Jersey Zinc Company, 160 Front Street, New York 38, N. Y.

The Research was done, the Alloys were developed, and most Die Castings are based on

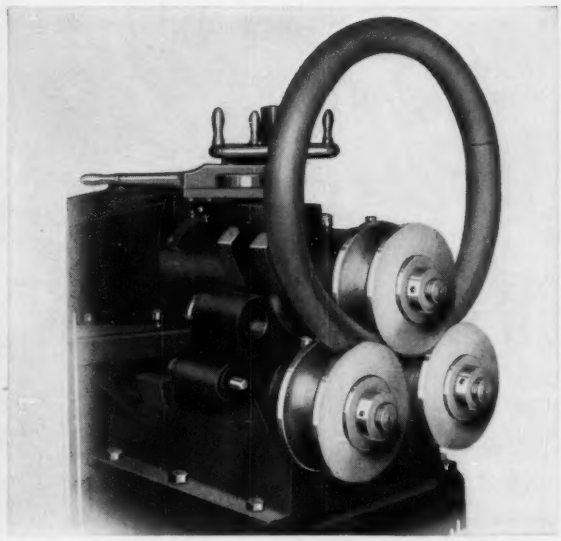
HORSE HEAD SPECIAL (99.99 + % Uniform Quality) ZINC

BEND THESE PIECES COLD —

with "Buffalo" Bending Rolls



The difficult leg-in angle bending is easily and accurately done on "Buffalo" Bending Rolls.



Bending 5" copper tubing on "Buffalo" No. 2 Bending Roll. Last pass after straight ends are trimmed off.

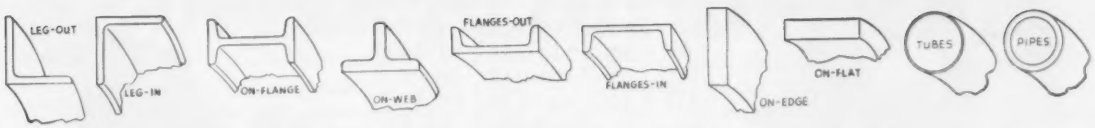
VERTICAL BENDING ROLLS

Capacities	½	1	2
Angles—leg out	2x2x⅛	3x3x⅛	4x4x⅝
Minimum diameter	20	24	40
Angles—leg in	1½x1½x⅛	2½x2½x⅜	3½x3½x⅝
Minimum diameter	18	30	48
Smallest Angle—leg out	¾x¾x⅛	1½x1½x⅛	1½x1½x¼
Minimum diameter	8	13	18
Smallest Angle—leg in	¾x¾x⅛	1½x1½x⅛	2x2x¼
Minimum diameter	9	14	24
Beams on flanges	3″-7½#	5″-12¼#	8″-18#
Minimum diameter	24	40	60
Channels—flanges out	3″-4#	5″-11½#	9″-20#
Channels—flanges in		5″-9#	7″-14¾#
Minimum diameter	16	18	48
Flats on edge	2x⅜	3x⅝	4x1
Minimum diameter	24	36	48
Flats on flat	3x¾	6x1	9x1¼
Minimum diameter	20	24	30
Rounds and squares	1½-1¼	2-1¾	2¾-2½
Minimum diameter	20	24	30
Copper tubes—12 gauge	1¾	3½	5
Copper tubes—16 gauge	2	4	6
Standard st. pipe	1½	2	3½
X heavy pipe	1¼	2	3
XX heavy pipe	1	1½	2½
Minimum diameter	16	20	24

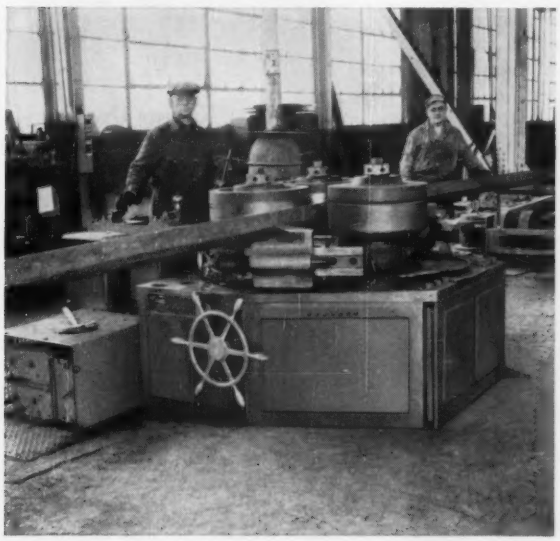
HORIZONTAL BENDING ROLLS

½	1	2	3	4
2x2x¼	3x3x⅜	4x4x⅝	6x6x⅞	8x8x1
20	24	40	60	84
1½x1½x¼	2½x2½x⅜	3½x3½x⅝	5x5x⅞	8x8x1
18	30	48	66	144
¾x¾x⅛	1½x1½x⅜	1½x1½x¼	2½x2½x⅜	3x3x½
8	13	18	30	36
¾x¾x⅛	1½x1½x⅜	2x2x¼	2x2x⅜	2½x2½x⅜
9	14	24	30	48
3″-7½#	5″-12¼#	8″-18#	12″-30#	15″-60#
24	40	60	72	96
3″-4#	5″-11½#	9″-20#	12″-30#	15″-55#
	5″-9#	7″-14¾#	10″-25#	15″-50#
16	18	48	60	72
2x⅜	3x⅝	4x1	6x1¼	8x1½
24	36	48	72	96
3x¾	6x1	9x1¼	12x1¾	12x3
20	24	30	36	60
1½-1¼	2-1¾	2¾-2½	3¼-3	5-4½
20	24	30	48	60
1¾	3½	5	....	....
2	4	6	....	....
1½	2	3½	5	8
1¼	2	3	4½	6
1	1½	2½	3½	5
16	20	24	36	60

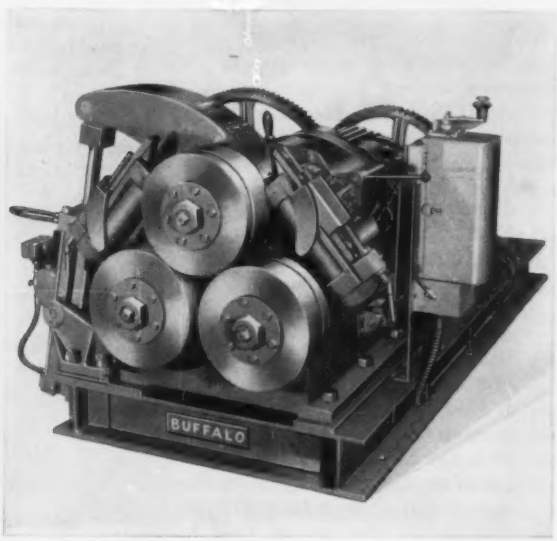
AT PRODUCTION-LINE SPEED



The sections above are easily bent into arcs, circles or spirals, using standard quick-change rolls.



"Buffalo" No. 3 Horizontal Bending Roll forming heavy angles for inside framework of large elevated tanks — rapid fabrication to close tolerances.



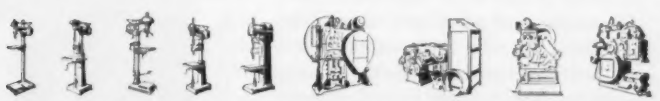
New "Buffalo" Vertical Bending Roll with instant release and positioning of work by hydraulically raised and lowered upper roll.

The table at left will give you an accurate picture of the wide range of sections you can cold-form into curved shapes at profitable speeds with the various sizes of "Buffalo" Bending Rolls. These machines are saving money in manufacturing hundreds of products with curved shapes, thanks to these "Q" Factor* features:

- **Instant stopping, starting, reversing by control lever**
- **Quick change, adjustment and release of rolls**
- **Long-wearing rolls of hardened and ground alloy steel forgings**
- **Available with leg-in attachment for angle bending**

Write for full details on all "Buffalo" Bending Rolls, including small Aircraft Type, Pinch-type, and Wrapping Rolls for forming cylinders. Request Bulletin 352.

**The "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.*



BUFFALO FORGE COMPANY

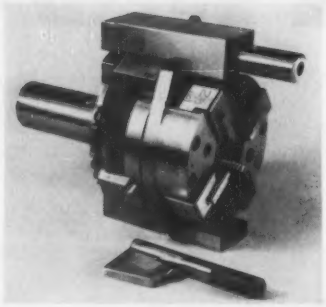
440 BROADWAY **BUFFALO, NEW YORK**

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

DRILLING PUNCHING SHEARING BENDING

ESTABLISHED 1877 "Buffalo" MEMBER N.M.T.B.A.

For more information fill in page number on Inquiry Card, on page 241



H & G Die-Head with Inserted Chasers

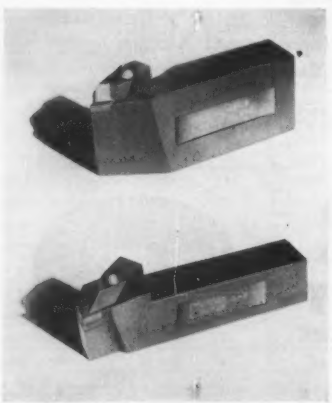
Style DMRT H & G insert chaser die-head brought out by the Eastern Machine Screw Corporation, New Haven, Conn. This recently developed die-head for the screw machine products industry is unique in that it will cut straight, regular taper, and reverse taper threads. It will cut 1/8- to 3/4-inch pipe threads and is intended for use on the No. 2 Brown & Sharpe automatic screw machine. The die-head is so designed that when cutting straight threads the carriers are held in a constant position. When cuting regular taper threads, the carriers are cammed for a receding action, and when cutting reverse taper threads, the carriers are cammed for a closing-in action.

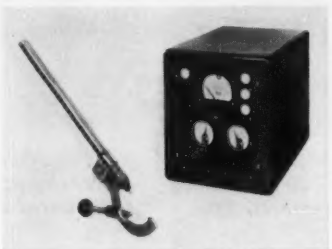
Circle Item 167 on postcard, page 241

Wesson Throw-Away Insert Tools

Two of three new holders for throw-away inserts added to the "Multicut" line of the Wesson Co., Ferndale, Mich. Both of the tools shown use Wesson standard, diamond-shaped D-55, solid throw-away inserts. The holders take right-hand (DAR), left-hand (DAL), and centrally mounted (MX-8-T5C) inserts and are designated as semistandard. All features, including method of locking and clamping, use of adjustable chip-breaker clamp, anvil relieved for build-up edge, etc., are similar to those in the standard line of "Multicut" holders. DAR and DAL holders are particularly suitable for plunge turning and facing operations. The MX-8 type is designed for such machines as the New Britain copying lathe. On all three types, inserts have four sets of cutting edges to which they can be progressively indexed before the tip is discarded.

Circle Item 168 on postcard, page 241

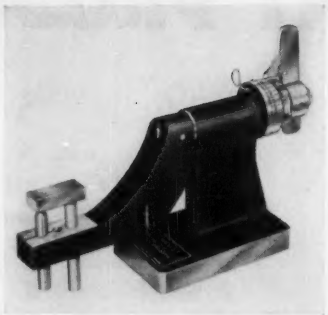




Automatic Control for Plunge-Feed Grinders

Electronic unit for automatic control of plunge-feed grinders announced by the Industrial Products Department of Airborne Instruments Laboratory, Inc., Mineola, N. Y. Known as the "MICROtrol" Type 150, this unit will gage the diameter of the work continuously during grinding, using the gaging information for automatic control of the final size of the work-piece. When used with a grinder that is equipped with electrically operated feed control and wheel withdrawal devices, the unit automatically controls such variables as the change from fast to slow infeed, amount of stock removal during spark-out, and wheel withdrawal at final size. Lights signal arrival at various size limits, including final size.

Circle Item 169 on postcard, page 241



Rothfuss Radius Dresser

Precision radius-dressing tool introduced by the Rothfuss Tool Co., Providence, R. I. Called the Rothfuss G-5, this low-cost radius dresser is designed for use with the company's G-2 angle dresser. With the new unit, radii and angles can be dressed tangent to each other. The G-5 dresser can form either a convex or concave radius from 0.015 inch to 1.750 inches on any grinding wheel up to 10 inches in diameter. Graduated stops allow the operator to dress any portion of a radius. A major feature of the dresser is its spring tension journal that insures chatter-free operation.

Circle Item 170 on postcard, page 241

Aircon Vapor Degreaser

Aircon Model 75 vapor degreaser made by Armstrong & White, Cheswick, Pa., for use in both large and small plants where economical installations are desired for continual or intermittent operation. A working area 24 by 40 by 24 inches, combined with a fast

(Continued on page 246)

BRIDGEPORT BRASS COMPANY

COPPER ALLOY BULLETIN

Bridgeport Brass Co.

Reporting new developments in copper-base alloys and metalworking methods.

Bridgeport Alloys Used for Heart of Transmitting Tubes

Today's rapid developments in radar and communications give increasing importance to the electron tube for generating and amplifying ultra-high and microwave frequencies for radar and communication systems.

In manufacturing electron tubes, Eitel-McCullough, Inc. of San Bruno, California—a leading producer of transmitting tubes—faced several difficult problems. The primary problem was that vacuum tube production requires firing at extremely high temperatures in a hydrogen atmosphere. Under these conditions, ordinary copper becomes spongy and porous. Specifying Bridgeport Oxygen-Free copper provides the solution.

Other major requirements for metals also exist. While the majority of electron tube components are formed, many are machined to exact dimensions from rod and tube. Eitel-McCullough requires a metal that can be easily fabricated in deep-drawing, is a good electrical conductor and is adaptable to plating. Here, too, Bridgeport alloys proved to be the solution.

Bridgeport alloys are used because they can meet Eitel-McCullough's exacting requirements in manufacturing and finished product performance, as well as providing consistently uniform composition. Bridgeport O.F.H.C. copper is used for many tube parts—anodes, support structures, coolers, cooler cores, drift tube sections, index sleeves and static sleeves.

Transmitting tubes are one of many products using Bridgeport Alloys for special applications. Your product, too, can use Bridgeport "job matched" alloy. Call your nearest Bridgeport sales office today.

The Importance of "Machineability"

Low-cost, large-volume production depends on the "machineability" of the metal used to do the job. In establishing the machineability ratings of alloys, Bridgeport Metallurgists consider these five factors the most important: speed of machining... tool life... finish... accuracy... and power required.

While copper and each of its alloys have individual characteristics, Bridgeport copper-base alloys have been grouped into three broad machineability classifications:

Free-Cutting Alloys

Machineability rating 100% to 70%. All alloys in this group are leaded, and produce short, brittle chips. For example, most jobs that call for free-cutting brass rod can be entrusted to Bridgeport Ledrite #6 Standard, machineability rating of 100%. Ledrite #6 is easy to cut, gives longer tool life... products are smooth, clean-surfaced.

Moderately Machineable Alloys

Machineability rating 70% to 30%. This group covers some leaded refractory alloys and some non-leaded brasses. Bridgeport Duronze III, a silicon aluminum bronze, is also included in this classification.

Difficult to Machine

This group includes non-leaded copper, phosphor bronze, silicon bronze, nickel silver and commercial bronze. All produce long, tough, stringy chips.

Finding the right metal or alloy, with the right machineability rating is no chore—if you call Bridgeport. Close cooperation with our Technical Service Division has worked wonders for many fabricators—increasing quality and uniformity, reducing waste, cost of labor and materials. Write or call your nearest Bridgeport Sales Office for high-quality alloys, and for free expert advice in your metal selections. (1155)

Bridgeport Brass Co.

BRIDGEPORT BRASS COMPANY ♦ BRIDGEPORT, CONNECTICUT

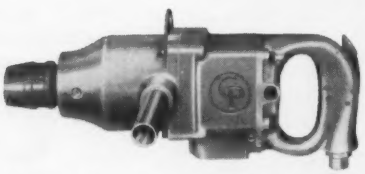
Mills at Bridgeport, Conn., Indianapolis, Ind., and Adrian, Mich. Sales Offices in Principal Cities—Conveniently Located Warehouses

For more information fill in page number on Inquiry Card, on page 241

SAVE TIME "ON THE LINE"

with

CP Air and Electric Impact Wrenches



CP-610-RP Reversible Air Impact Wrench with pistol grip.

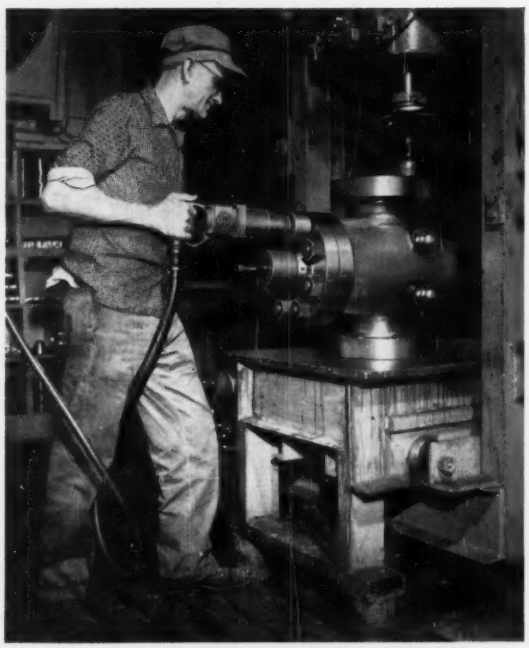
CP-3440-RS Reversible Air Impact Wrench with ½" sq. drive shank.

CP-903R Kit-Packed Electric Impact Wrench with ½" square drive.

2000 blows per minute give the CP-903-R Universal Electric Impact Wrench fast, powerful impact action. Nose section measures only 2" in diameter . . . affords easy access to tight, hard-to-get-at spots. Has rated ⅜" bolt size capacity but handles many ⅝" applications. Available with carrying case containing six hex sockets and drill and tap chuck.

TABLE OF CAPACITIES

Wrench Number	Bolt Size
AIR	
CP-337	¼"
CP-334	⅜"
CP-3440	⅜" heavy-duty
CP-349	⅝"
CP-3490	⅝" heavy-duty
CP-360	¾"
CP-3630	¾" heavy-duty
CP-610	1¼"
CP-375	1¾"
ELECTRIC	
CP-903-R	⅜" - ⅝"



Check the fast-moving, smooth-running production lines in industry and you'll find Chicago Pneumatic reversible Air Impact Wrenches at work, stepping up output, stepping down costs. You'll find Air Tools like the CP-610 saving 25% to 75% of nut running and removal time. You'll find angle head models in all sizes, adding ease to jobs that are normally awkward and hard-to-reach. Other CP Air Wrenches available in capacities from ¼" bolt size to 1¾". Pistol, spade or side handle models are available.

Chicago Pneumatic

8 East 44th Street, New York 17, N. Y.

Pneumatic Tools • Air Compressors • Electric Tools • Diesel Engines
Rock Drills • Hydraulic Tools • Vacuum Pumps • Aviation Accessories

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PRODUCT INFORMATION SERVICE

Use postage-free Business Reply Cards for further information
On New Catalogues described in this issue of MACHINERY
On New Shop Equipment described in the editorial pages
On products shown in the advertisements

NEW CATALOGUES

DRAFTING PRACTICES—American Machine & Foundry Co., 261 Madison Ave., New York 16, N. Y. 56-page booklet entitled "Standard and Simplified Drafting Practices." The first section contains a speech given by Jay H. Bergen, the company's standards administrator, before the American Society for Engineering Education. The remaining pages are devoted to the details of AMF standards on drafting-room practice and simplified drafting. Copies of this booklet may be obtained by writing on a company letterhead to the public relations department of the above company.

SPECTROSCOPIC ELECTRODES AND POWDERS—National Carbon Co., Division of Union Carbide and Carbon Corporation, New York City. 16-page catalogue giving detailed listings and descriptions of the company's complete line of spectroscopic electrodes and powders. Photographs and dimensional drawings illustrate special-grade preformed electrodes of the following types: cupped, necked, plain, porous cup, curved platform, angular platform, counter, rotating disc, rotating platform disc, tapered mandrel, boiler cap, and anode caps and pedestals. Also described are special-grade 12-inch electrodes and powders and regular-grade electrodes. . . 1

CENTRIFUGAL PUMPS—Ingersoll-Rand Co., Cameron Pump Division, New York City. Bulletin covering the complete line of Class CRV cradle-mounted centrifugal pumps which have capacities from 5 to 2800 gallons per minute and pressure of 10 to 525 feet total head. A concise tabulation of pump types with their ratings enables pump users to select the correct unit. A cross-sectional view points up design features common to this line. Various models are described and their applications listed individually. Typical installation views of the models, performance tables, and dimensions for the entire line are shown. 2

ROLL-GRINDING MACHINES—Landis Tool Co., Waynesboro, Pa. 26-page catalogue describing the Type 30 roll-grinding machine. Having 32 illustrations, the catalogue gives a complete description of the machines, specifications, and standard and extra equipment available. The roll grinders are available with swings of 36, 44, 50, and 60 inches and center distances from 10 to 24 feet. Rolls ranging in weight from 45 to 82 1/2 tons can be accommodated, depending on the size of the machine. 3

CARBIDE TOOLS—Allegheny Ludlum Steel Corporation, Carmet Division, Detroit, Mich. Revised 32-page booklet giving detailed information, charts, and other data on carbide applications and available tools with carbide tips. Data on all the company's products, including standard blanks, insert blanks, throw-away blanks, special blanks, standard tools, die sections and punches, die inserts, and piercing punches and bushings, are included. In addition, there is a section on the selection of carbide grades. . 4

PRECISION HOLE BORER—Canton Tool Mfg. Co., Canton, Ohio. Booklet giving details on the company's precision hole borer which employs a principle to permit production center-drilling, drilling, and boring operations at eight times the speed of conventional jig-boring methods. The bulletin contains sequence photographs showing how, after a basic template is produced, repetitive parts can be bored to high precision without requiring setup and alignment for each part. 5

BORING HEADS—Briney Mfg. Co., Pontiac, Mich. 12-page Catalogue 6B, illustrating six standard precision boring heads and an adjusting principle for close-tolerance boring. The adjusting principle consists of a bushing mounted on preloaded ball bearings between the flange and the boring-bar. The bushing hole is slightly eccentric with its outside diameter, providing an adjusting range for the boring-bar of 0.012 inch on the diameter. 6

AUTOMATIC V-BELT CLUTCH—Rev-O-Loc Clutch Corporation, Milwaukee, Wis. Bulletin ROL-1255, describing an automatic V-belt clutch that utilizes belt pull to obtain a speed spread between engagement and release and increase clutch capacity. Photographs, line drawings, and schematic drawings illustrate the clutch parts and explain the principle of operation. Specifications and characteristics are included. 7

EXTRUSION PRESSES—Lake Erie Engineering Corporation, Buffalo, N. Y. 8-page Bulletin 14.17, illustrating the complete line of Lake Erie presses for extrusion of ferrous and non-ferrous metals. Basic design features, such as the billet loader, die slide, inserted steel cylinder, and shear construction, are pictured in detail and accompanied by a concise explanation of their advantages. 8

AUTOMATIC SCREW MACHINES—Gear Grinding Machine Co., Detroit, Mich. Comprehensive catalogue revealing the latest design and production advances in single-spindle bar automatics. This completely illustrated catalogue describes in detail such features as turret and cam drive, cross and vertical slides, stock feed and collet chuck, turret slide assembly, and open front design, and it also includes easy setup suggestions. 9

ROLLER CHAIN AND SPROCKETS—Link-Belt Co., Chicago, Ill. 148-page book describing the company's line of precision roller chain and sprockets. Included are sections on stock drives, drive chain, conveyor chain, installation and maintenance, lubrication, sprocket

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wheels, casings, and chain tighteners. Thoroughly illustrated, this book gives all information necessary to choose the right roller chain for a given application. . .10

VERTICAL INJECTION MOLDING MACHINES—Watson-Stillman Press Division, Farrel-Birmingham Co., Inc., Roselle, N.J. 8-page Bulletin 627-B, describing the operating features of the company's vertical plastics injection molding machines which are available in 1-, 2-, 6-, 16-, and 24-ounce capacities. Complete information on machine specifications and physical dimensions is also included. 11

BARREL-FINISHING METHODS—Oakite Products, Inc., New York City. Folder covering the problems and requirements of barrel-finishing from precleaning to final rinse. Included is information related to the use of cutting and descaling solutions, selection of proper finishing materials, alkaline versus acid type compounds, burnishing solutions, water levels, and media-to-work ratios. 12

PRELOAD INDICATING WASHERS—Standard Pressed Steel Co., Jenkintown, Pa. 12-page catalogue giving instructions and technical data on the complete line of PLI-Washers. Theory of operation and standard specifications of the washer assemblies are included. The assemblies, consisting of two concentric steel rings sandwiched between two close-tolerance washers, become an integral part of a connection. 13

ROTATING HYDRAULIC DRIVES—Oilgear Co., Milwaukee, Wis. Bulletin 15011, containing the reprint of a talk by Milton G. Malmquist of Minnesota Mining & Mfg. Co. on the topic of automation and its application in performing operations on continuous webs. Tension, speed, control, acceleration, deceleration, torque, and synchronization are some of the problems covered. 14

UNLOADING MACHINES—Sahlin Engineering Co., Birmingham, Mich. Catalogue illustrating and describing typical applications of the company's Iron Hand for automatic press unloading operations. The catalogue includes information on the overhead Iron Hand, the portable model for floor operations, turnover and transfer machines, as well as other unloading machines used by mass-production industries and job shops. 15

POSITIONING TABLE—Binotrol Division, Barnes Engineering Co., Stamford, Conn. 2-page bulletin listing uses, tape preparation, operating principles, and specifications of the Binotrol positioning table. Photographs illustrate its adaptability to a variety of machine tools and show how it may be used to drill, ream, sink, tap, mill, screw, or perform any of the unusual machine-shop operations. 16

THREE-STAGE TORQUE CONVERTER—Twin Disc Clutch Co., Hydraulic Division, Rockford, Ill. Bulletin 507, describing the Series 13,800 three-stage torque converter. The unit has one standard output shaft assembly and three input arrangements. Illustrations are used to explain the construction and application of the converter. 17

ROTARY GRINDING MACHINES—Thompson Grinder Co., Springfield, Ohio. Catalogue describing the Type TR twin rotary grinding machines. Photographs of the circular grinding machines with descriptions and locations of controls and other features, together with complete specifications, are included. 18

OIL COOLERS—Vickers Incorporated, Detroit, Mich. 8-page Bulletin 55-69, describing the company's line of air type and water type hydraulic oil coolers for industrial hydraulic systems. Cut-away views are included, and design and construction features of the Series OCW water type and OCA air type coolers are described in detail. 19

TWO-WAY DIRECTIONAL CONTROL VALVES—Oilgear Co., Milwaukee, Wis. 16-page Bulletin 80200, describing two-way directional control valves for fluid power systems up to 3000 pounds per square inch. Included are details of the valve body construction and the functions of standard and special plungers. 20

RING AND CIRCLE SHEAR—Niagara Machine & Tool Co., Buffalo, N. Y. Bulletin 70 Supplement, describing the company's 31-RC ring and circle shear. Complete details and specifications are given, plus a description of the self-compensating circle arm that floats on guided ways to maintain true center automatically. 21

MELTING FURNACE ACCESSORIES—Lindberg-Fisher Division, Lindberg Engineering Co., Chicago, Ill. 8-page Catalogue 601, describing a complete line of auxiliary items commonly used in conjunction with melting furnaces in the foundry. Charts giving dimensions, burner and blower ratings, and burner cross-section diagrams are provided. 22

AUTOMATED SPEED CONTROL SYSTEMS—Graham Transmissions Inc., Menomonee Falls, Wis. Bulletin C-100, showing ways in which automated speed control is used in such applications as maintaining constant-velocity feeding and winding, variable-rate proportioning, and punch-card product blending. . . .23

CURVED-TOOTH MILLING CUTTERS—Aber Engineering Works, Inc., Waterford, Wis. Catalogue presenting the company's line of curved-tooth milling cutters. The cutting action obtained with this tooth shape is described. Included is a data sheet "How to Sharpen Curved-Tooth Milling Cutters." 24

VARIABLE-SPEED TRANSMISSIONS—Maurey Mfg. Co., Chicago, Ill. Catalogue describing "Maureymatic" variable-speed transmissions providing simple, low-cost speed adjustment for machines using up to 10-H.P. V-belt drives. The transmissions are available for factory assembly of new equipment and for quick, easy installation on machines already in service. 25

CARBON-STEEL TUBING—Babcock & Wilcox Co., Beaver Falls, Pa. 4-page technical folder TDC-142A, furnishing condensed data on the mechanical and physical properties of seamless and welded carbon-steel pressure tubing and giving information on the various fabricating operations normally performed on such tubing. 26

BERYLLIUM COPPER—American Silver Co., Flushing, N. Y. Technical data sheet A-300, containing numerous tables and graphs, features a section detailing the specification methods for heat-treating beryllium copper. The data sheet gives the engineering specifications on several of the more generally employed beryllium-copper alloys. 27

Product Information Service

Use postage-free Business Reply Card below for further information on New Catalogues or New Shop Equipment described in this issue and products mentioned in the advertisements.

PLEASE SEND US MORE INFORMATION. Circle below item numbers on which you wish further information.

CATALOGUES

1	2	3	4	5	6	7	8	9	10	11	12	13	14
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WELDING CONTROL—Sciaky Bros., Inc., Chicago, Ill. Bulletin 338, describing the Dekatron predetermined, electronic counter welder control which counts cycles of power-line frequency to control welder sequence. The bulletin is divided into two sections—development of welder controls and specific features of the Dekatron tube type welder control. 28

INDUSTRIAL DIAMOND PRODUCTS—Diamond Tool Research Co., Inc., New York City. Catalogue 5, giving information on diamond dressing and truing tools, cutting and boring tools, powder, compound, and plated mandrels. Descriptions are given of the qualities of diamond tool stones offered, and blueprints are shown. 29

DESCALING MACHINES — Pangborn Corporation, Hagerstown, Md. 16-page brochure No. 608, describing equipment for continuous, mechanical descaling by shot-blasting. Photographs and drawings illustrate details of construction, actual installations, and specifications. 30

FLEXIBLE SHAFTING—Stow Mfg. Co., Binghamton, N. Y. Bulletin 570, describing and illustrating typical installations using flexible shafting. It furnishes complete information on all sizes of shafting from 1/8 inch to 1 5/8 inches in diameter for both power-drive and remote-control applications. 31

DUST COLLECTOR—Pangborn Corporation, Hagerstown, Md. 8-page brochure 920, describing the Type CV-Ventrijet for wet collection of industrial dusts. Fifteen action photographs and drawings are included. Dimensions, weights, and capacities are presented in three tables. **32**

FILTERS—Marvel Engineering Co., Chicago, Ill. Revised Bulletins Nos. 107 and 301, describing Synclinal filters for hydraulic oils, coolants, and lubricants; and filters for water, respectively. Also available is Bulletin 200, containing complete data on filters for fire-resistant hydraulic fluids. 33

SOLENOID VALVES—Automatic Switch Co., Orange, N. J. 32-page Catalogue No. 201, describing the latest designs in the ASCO line of two-, three-, and four-way solenoid valves. Engineering information, flow charts, operation and construction details, and illustrations are included. **34**

CYLINDRICAL GRINDING—Ready Tool Co., Bridgeport, Conn. Folder introducing the company's Red-E grinding concept claimed to overcome chatter, wheel marks, out-of-roundness, and the costly secondary operations required for superfinishing and lapping in cylindrical grinding. 35

TUBES—Babcock & Wilcox Co., Tubular Products Division, Beaver Falls, Pa. Bulletin TB-412, giving information on resistance-welded carbon-steel tubing for applications involving heat transfer. A chart outlining the hydrostatic test pressures required for the various sizes of tubes under ASTM A-214 is also shown. **36**

LOW-TEMPERATURE CABINET—Webber Engineering Corporation, Indianapolis, Ind. Bulletin 61, describing the company's Model WE-2-140 2-cubic foot capacity sub-zero temperature cabinet with front or top opening for testing of electronic components, cold-treatment of metals, thermal contraction, and expansion fitting. 37

CARBIDE-TIPPED GUN DRILLS—Chicago-Latrobe, Chicago, Ill. Folder describing the company's precision-made carbide-tipped gun drills, designed for use in such applications as drilling of rifle barrels, long shaft oil-holes in connecting-rods, and similar operations. Technical data is included. 38

POWER TAKE-OFFS—Twin Disc Clutch Co., Racine, Wis. Bulletin 308, describing the company's entire line of friction power take-offs. Information is given on horsepower and torque capacities, side pull limitations, and dimensions for all Twin Disc power take-off clutches. **39**

CLEANING AND QUENCHING OILS—Sun Oil Co., Industrial Products Department, Philadelphia, Pa. Technical Bulletins 44 and 45, describing the company's "Sunvis 700 oils" for cleaning sludge out of hydraulic and lubrication systems without shutting down machines and "Sunquench 78," a fast quenching oil, respectively. 40

TURRET LATHES—Gisholt Machine Co., Madison, Wis. Bulletin 1174-B, describing the company's ram type universal turret lathes. Complete specifications are given. The booklet is divided into four sections: machine features, machine accessories, tools, and floor plans. ..41

HOLDING TOOLS—Seibert & Sons, Inc., Chenoa, Ill. 6-page circular illustrating and describing several tools from the company's line such as slip-spindle assemblies, drill and tap drivers, spindle extension assemblies, adapters, and turret tool-holders. 42

RUST PREVENTIVES AND COATINGS—F. E. Anderson Oil Co., Inc., Portland, Conn. Data chart describing the company's rust preventives and coatings for industrial applications. Twelve different products are described in convenient chart form. 43

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COMPRESSION TESTING MACHINES—National Forge & Ordnance Co., Irvine, Warren County, Pa. Brochure 551, describing the company's compression testing machines for large-volume production testing and exacting laboratory programs. 44

SPRINGS — Wales-Strippit Corporation, North Tonawanda, N. Y. Catalogue K, describing the company's Hydra springs with spring force up to 85,000 pounds, using compressible liquids. Complete data and specifications are given. ...45

INDUSTRIAL SPRAY NOZZLES—Monarch Mfg. Works, Inc., Philadelphia, Pa. Catalogue giving capacity charts and information on the company's standard items, as well as numerous new items which have recently been added to the line. 46

TURRET TOOL-HOLDERS—Scully-Jones & Co., Chicago, Ill. Bulletin 7-50, describing the company's sleeves and sockets and turret tool-holders. Specifications for precision sleeves, extension sockets, and turret tool-holders are given. ...47

TOOL STEEL—Heat Treating Division, Wiedemann Machine Co., Philadelphia, Pa. Folder, entitled "Factors to Consider About Tool Steel," giving information on uncompensated shrinkage or expansion caused by heat-treating. 48

NONDESTRUCTIVE TESTING—Magnaflux Corporation, Chicago, Ill. 12-page booklet entitled "Seeing Isn't Always Believing," describing the progress being made in the field of nondestructive testing. 49

BEARING MATERIALS—Bound Brook Oil-Less Bearing Co., Bound Brook, N. J. Chart showing the complete chemical, mechanical, and work characteristics of a wide range of sintered bearing materials. 50

ELECTRO CLUTCH—I-T-E Circuit Breaker Co., Philadelphia, Pa. Bulletin describing the company's electro clutch for applications where many output speeds are desired with a constant input speed. ..51

TRACTION MOTOR—General Electric Co., Schenectady, N. Y. Bulletin GEA-6532, giving design, construction, and application features of the company's traction motor. Included are performance data, available ratings, and mounting information. 52

DRILLING MACHINES—Speed Control Division, Fairchild Engine & Airplane Corporation, St. Augustine, Fla. 4-page illustrated folder describing the company's Speedy Driller for high-speed, semi-automatic index drilling. 53

OPTICAL COMPARATOR—Covel Mfg. Co., Benton Harbor, Mich. Bulletin 1456C, describing the company's No. 14 optical comparator which permits economical precision inspection. 54

LUBRICATION — Lubriplate Division, Fiske Bros. Refining Co., Newark, N. J. 15-page data book 56-1, describing proper lubrication of all machinery. ..55

FASTENERS—Standard Pressed Steel Co., Jenkintown, Pa. 30-page revised catalogue covering the company's standard Unbrako fasteners. Easy-to-read tables show size ranges and specifications. 56

EXPLOSION-PROOF MOTORS—General Electric Co., Schenectady, N. Y. 8-page Bulletin GEA-6341, describing the design features and maintenance of new induction motors, 1 through 30 HP., for use in hazardous locations. 57

HEAVY-DUTY CARBIDE—Firth Sterling, Inc., Pittsburgh, Pa. Folder describing the company's line of specially engineered designed for general-purpose, heavy-duty work. Graphical charts and performance reports are included. 58

DISC GRINDERS—Besly-Welles Corporation, Grinder Division, Beloit, Wis. Illustrated catalogue describing the company's disc grinders. Detailed specifications, dimensions, and performance data are included. 59

COMPACT CANNED MOTOR PUMP—Chempump Corporation, Philadelphia, Pa. Bulletin 1060, describing and illustrating Series E Chempump, a compact canned motor pump that is less than 8 inches long. 60

WELDING EQUIPMENT—Acro Welder Mfg. Co., Milwaukee, Wis. 12-page illustrated Bulletin 156, describing the company's line of specially engineered and standard resistance- and arc-welding equipment. 61

GROUND FLAT TOOL STEEL—Capewell Mfg. Co., Hartford, Conn. Combination wall chart and file folder listing all standard sizes of the company's Microloy ground flat tool steel. 62

DECIMAL EQUIVALENT CHART—Dayton Rogers Mfg. Co., Minneapolis, Minn. Combination decimal equivalent chart and calendar dated from July, 1956 through June, 1957. 63

DIE STEEL—Vanadium-Alloys Steel Co., Latrobe, Pa. Booklet describing the company's "Speed-Cut" free-machining die steel. 64

DIAL GAGES—Boice Mfg. Co., Inc. Staatsburg, N. Y. Bulletin 55, describing the company's line of dial gages and setmasters. 65

IMPACT WELDER — Taylor-Winfield Corporation, Warren, Ohio. Bulletin 2-063, describing the company's impact welders. 66

PLEASE SEND US MORE INFORMATION. Circle below item numbers on which you wish further information.

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RB&W FASTENER BRIEFS

RUSSELL, BURDSALL & WARD BOLT AND NUT COMPANY

Technical-ities

By John S. Davey

The important facts about nuts

A nut's purpose is to load the bolt in tension for a tight joint. For this, it is given shear strength greater than the breaking point of the bolt; and sufficient bearing area to avoid crushing or flow of the bearing surface with consequent reduction of tension.

While the thread form of a nut is accurate, its "lead" cannot, for practical purposes, be made identical with that of the bolt. Thus, a nut is made from material plastic enough to allow the threads to deform upon tightening and thereby adjust to distribute the load over many threads rather than concentrate it on the first few.

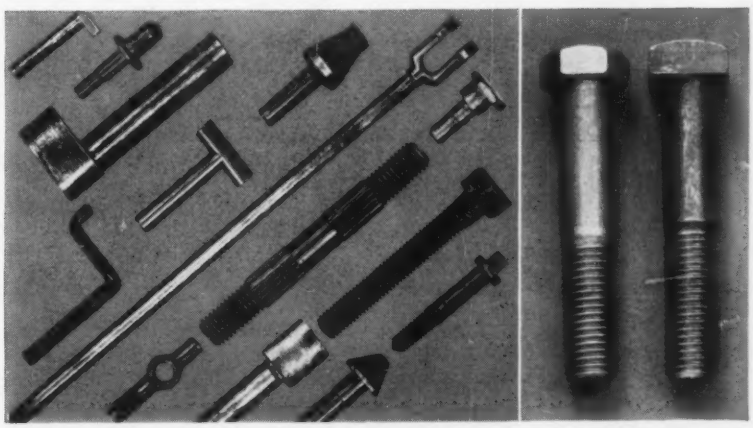
WHAT TO USE

The standard "Finished" nut series satisfies the requirements. It gives not only the required bearing area, but also enough section for proper strength and to minimize the spreading or dilation of a nut when loaded. (The standard "Heavy" nut series is called for only when bolt holes have large clearances, or for high bolt loads.)

As a good general guide to follow, use nuts that are:

1. Made to Am. Std. dimensions;
2. Made from soft, ductile material;
3. Strong enough to break the bolt or screw with which it is used. This would determine whether "Finished" or "Heavy" series is selected.

Cold heading produces strong, low cost parts



Representative range of mechanical parts produced by RB&W by cold heading . . . the same process used to produce the high quality, economical RB&W standard bolts and cap screws shown at right.

Here's a product-improving fact often overlooked: The same forming operation that produces large volumes of strong fasteners at surprisingly low cost can also be used for headed, special mechanical parts.

Cold heading upsets metal along its own axis. Flow lines are continuous, without folds, giving greater head strength against shear, fatigue and impact. Moreover, the material has better quality to start with, since unsound metal would distort or open in the operation and be rejected automatically. Uniformity is assured. Finish is also better.

Designers and production men get all these physical advantages when using RB&W standard bolts and cap screws. They can also have them in special parts at low cost when the need is of sufficient volume to justify machine set-up time. For more information and help on your specific needs, write Russell, Burdsall & Ward Bolt and Nut Company, Port Chester, N.Y.

Plants at: Port Chester, N.Y.; Coraopolis, Pa.; Rock Falls, Ill.; Los Angeles, Calif. Additional offices at: Ardmore (Phila.), Pa.; Pittsburgh; Detroit; Chicago; Dallas; San Francisco.

30% faster assembly— and joints stay tight

When famous-make chain saws were fastened with regular screws plus washers, they loosened on the job. Then SPIN-LOCK screws were used. These not only held tight, they also speeded assembly time 30%. What's more, they cost no more than former screw plus lock washer.

SPIN-LOCK screws have self-anchors in the form of hardened, tiny teeth which dig in and hold under severe service. Various types, sizes and heads available. Send for data or see Sweet's Product Design File.

cleaning cycle, permits handling in excess of 750 pounds of steel per hour. Solvent requirements are 16 gallons for the boiling sump and 24 gallons for storage. Trichlorethylene or perchlorethylene solvents can be used. The degreaser is constructed of heavy-gage steel with a rust-inhibitive interior coating and operates on 220-volt alternating current.

Circle Item 171 on postcard, page 241

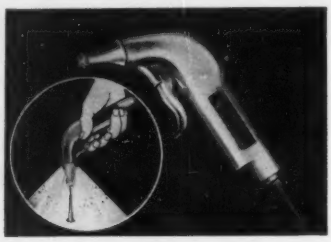
Tomkins-Johnson Replaceable Head Reamers

Reamers with interchangeable and replaceable heads introduced by Tomkins-Johnson Co., Jackson, Mich. These reamers are designed so that only the quickly installed head needs replacing after buying the original shank. The tapered hole in the head insures concentricity, while the new thread design assures a snug fit on the smoothly ground tapered shank. Heads can be quickly and easily changed when dull or to suit work on different metals. A wide range of interchangeable heads is available from 1/2 inch to 2 3/4 inches, inclusive, in 1/16-inch increments with right- or left-hand spiral flutes for through or blind hole reaming.

Circle Item 172 on postcard, page 241

"Guardair" Safety Gun

Safety air gun which provides a protective umbrella of high-pressure air announced by the Union Engineering Corporation, South Hadley Falls, Mass. Called the "Guardair," this new air gun utilizes a patented principle by means of which an air stream is diverted through fluted passages to set up a conical shield of high-pressure air which helps prevent chip "flyback." This protective



screen operates simultaneously with the air jet so that the gun cannot be used without the safety feature.

Circle Item 173 on postcard, page 241

Kinetics Vacuum-Brazing Equipment

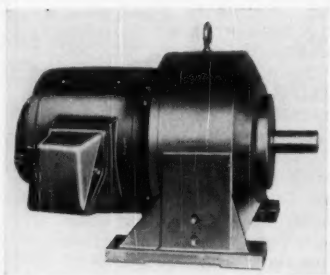
Equipment for production vacuum brazing of intricate honeycomb structures and complex casting assemblies brought out by Kinetics Corporation, Hingham, Mass. The manufacturer of this equipment provides experimental facilities for working out customers' problems and for producing samples for analysis. While the process lends itself well to difficult brazing problems, it can greatly improve the quality of regular furnace brazing work. Assemblies up to 32 inches in diameter by 27 inches long can be handled.

Circle Item 174 on postcard, page 241

"Imp" Hold-Down Vise

Model 3 "Imp" hold-down vise added to line of equipment made by Illinois Metal Products, Chicago, Ill. The low design of this 3-inch vise makes it especially adaptable for surface grinding non-ferrous metals. It also works equally well for small milling jobs. The vise has two hinged pull-down jaws that draw the work downward and seat it accurately and tightly, in seconds, without the use of parallels or hammering. Interchangeable heavy hold-down jaws increase its versatility.

Circle Item 175 on postcard, page 241



Reliance Gear-Motor

Gear-motor available in both alternating- and direct-current types, from 1 through 60 H.P., announced by Reliance Electric & Engineering Co., Cleveland, Ohio. These gear-motors combine the latest design principles of mechanical gearing and electrical motor development and are built to give long trouble-free performance under the most adverse operating conditions. They have two-way seals that lock oil in and seal dirt out so that they can be mounted in virtually any position without danger of oil leakage. The gear-motors are available in a wide range of mountings, enclosures, and drive ratios.

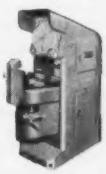
Circle Item 176 on postcard, page 241

DROODLES

by ROGER PRICE

Bench Model BC-7

Floor Model FC-30



Floor Model FC-14

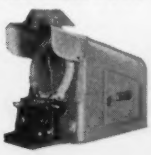


Table Model TC-14
(Vertical Inspection)

"BOBSLED RUN FOR FLEAS"

Although it seems screwy, here's proof that fleas have *their* Olympic Games, too! And they're mighty impressive, so I understand. After singing their stirring anthem "The Battle Cry of Flea-dom", the little chaps plunge into a series of thrill-ing athletic events. In addition to the 50-inch dash, there's the brad jump, the poodle vault and and the pocket mirror-thon. The main event is the golf match over the rugged Airedale course. The competitors in this are especially jumpy, because it's a tricky layout complete with dog-legs, and they all start from scratch.

While you're here — if you are — I'd like to put a flea in your ear about the J & L Comparator. It is an ingenious inspecting and measuring instrument that speedily and precisely handles all sorts of parts and objects, in a variety of sizes and shapes. The J & L Comparator is accurate to .0001", and is equally suited to both production-line and job-shop work. It is extremely flexible in application, and enables you to perform inspections that are not possible by any other method. Available in eleven models. Interested? Write Dept. 710 for complete information *today!*

JONES & LAMSON OPTICAL COMPARATORS

- "KEY INSTRUMENT IN INSPECTION"
- "PROTECTS QUALITY PRESTIGE"
- "CUSTOMERS' REJECTIONS KEPT VERY LOW"
- "SAVES FROM $3 TO $5 PER HOUR"

Modern Corporation, Detroit, Michigan, manufacturer of fine MODCO cutting tools, says this about their 30-inch J & L Comparator: "Modern Corporation's 30-inch J & L Comparator has become the key instrument in the inspection of fine MODCO tools. Its size enables the inspector to examine the complete contour of most tools, without transfer of reference points, and thus without the chance for human error to creep in."

Photo courtesy of Modern Corp., Detroit, Mich.

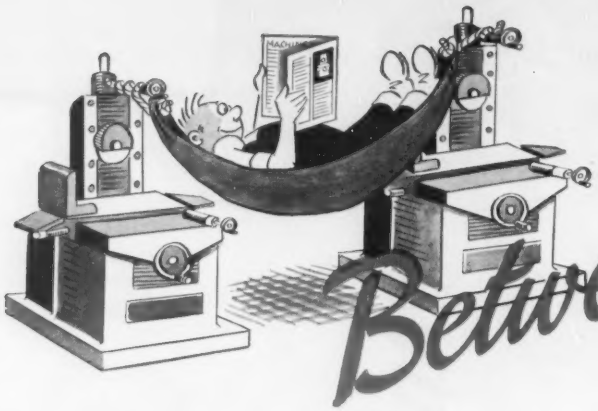
While the primary reason Modern Corporation bought the Comparator was to promote inspection accuracy, it is showing an important cost saving: Every time the J & L Comparator is used on large tools, it saves from three to five dollars per hour.

JONES & LAMSON

World's Largest Manufacturer of Optical Comparators since 1919

JONES & LAMSON MACHINE COMPANY, 512 Clinton St., Springfield, Vt., U.S.A.

OPTICAL COMPARATOR DIV.



Between Grinds

By E. S. Salichs

A Warn Welcome

An aircraft executive in San Diego has created his personal antidote for ulcers and/or high blood pressure—a sign hung over his desk which reads: "While in this room, speak in a low, soothing tone, and do not disagree with me in any manner. Please be informed that when one has reached my age, noise and non-concurrence cause gastric hyper-peristalsis, hyper-secretion of the hydrochloric acid, and rubus of the gastric mucosa, and I BECOME MOST UNPLEASANT." Although a difficult visitor may see red, the exec. keeps in the pink.

All Agreed

The editorial published in May MACHINERY, "No Time to Read," evoked much favorable comment, including a letter from a reader who recalled this incident from the past. Seems that at a time when he was moving his young and growing family to a distant location, he asked his uncle, a general medical practitioner of high reputation, how he should go about selecting a competent family doctor in the new community. "Ask him how much time he puts in on reading medical journals," was the answer. Today, the time spent in reading technical journals in one's particular field provides a similar gage, our correspondent implied.

A Baseball Beef

In the Spring a young man's fancy turns, yes, to baseball and hence this story. Several of our Editors lunch at a restaurant that features Yankee pot roast, and the part before the "pot" disturbed one or two of them who are fans of the team that grew in Brooklyn. Needled daily, the owner of the restaurant changed the menu to read "Yankee or Dodger pot roast."

Change Here, It Says

The Directomat, a push-button machine which tells how to go where by subway in New York City, was recently installed in the Times Square station. Bewildered visitors to the city, and residents too, can step up to the red panel of 120 buttons and push a number corresponding to any one on the directory which lists all the subway stations and various points of interest throughout the city. The machine whirs, and five to twelve seconds later a printed ticket drops out, giving specific directions on how to get to the destination—by subway, of course. Changed your mind, lady? Start over.

WIRE, WOMEN, AND WONDER—The United States Steel Corporation, delving into the past, shows us how the ladies played a vital part in building America's wire industry. Beginning with the hoop skirts of the 1850's, Washburn & Moen, the nation's pioneer wiremakers, produced 60,000 pounds of crinoline wire a week—half the requirements of the entire country. Then Lillian Russell, of Gay Nineties fame, boomed wire sales, the fashions of her day calling for long hatpins, Gainsborough hats, corsets, bustles, sweeping skirts, and parasols, all of which used wire extensively. And here is a picture of statuesque Lillian herself, wearing some of the items mentioned, although we can't precisely say which!

Fashions for 1867.
J. W. BRADLEY'S
DUPLEX ELLIPTIC
(OR DOUBLE)
SPRING SKIRTS.
Will not BEND or BREAK like the SINGLE SPRINGS, but will PRESERVE their PERFECT and GRACEFUL SHAPE, where other SKIRTS are thrown aside as USELESS!
EMPRESS TRAIL.
DUPLEX ELLIPTIC.

"Same Day" Shipment

from Ex-Cell-O's huge stock of precision

Drill Jig Bushings

Whatever your requirements, Ex-Cell-O's complete bushing service will give you full satisfaction with every order! For your convenience, Ex-Cell-O maintains huge stocks of precision Drill Jig Bushings, and efficient expediting facilities which make possible "same day" shipment. This means orders are filled and dispatched from complete inventories in New York, Detroit, Los Angeles and London, Ontario, within a few hours after they are received!

Made of wear-resistant bearing steel, Ex-Cell-O Drill Jig Bushings are precision machined to meet Ex-Cell-O's rigid quality standards. Ex-Cell-O's exclusive hardening process produces bushings guaranteed uniform within 62-64 Rockwell "C". All Ex-Cell-O bushings are heat treated in Ex-Cell-O's atmosphere-controlled equipment. You can count on the tested and proved superiority of these high chrome, high carbon, oil hardening bearing steel bushings.

Call, wire or write Ex-Cell-O for the world's finest, fastest and most complete bushing service!

1. Headless Press Fit Bushings are used when center distances are too close for bushings with heads. **2. Head Liners** are used (in place of headless liners) when excessive pounding is involved. **3. Fixed Renewable Bushings** are used with liners when replacement bushings are required during the life of the jig. **4. Slip Renewable Bushings** are used with liners when two or more operations require change. **5. Headless Liners** are pressed permanently into the jig plate for accurate replacement of renewable drill bushings. **6. Head Press Fit Bushings** are used when bushing replacement is not required during the life of the jig.

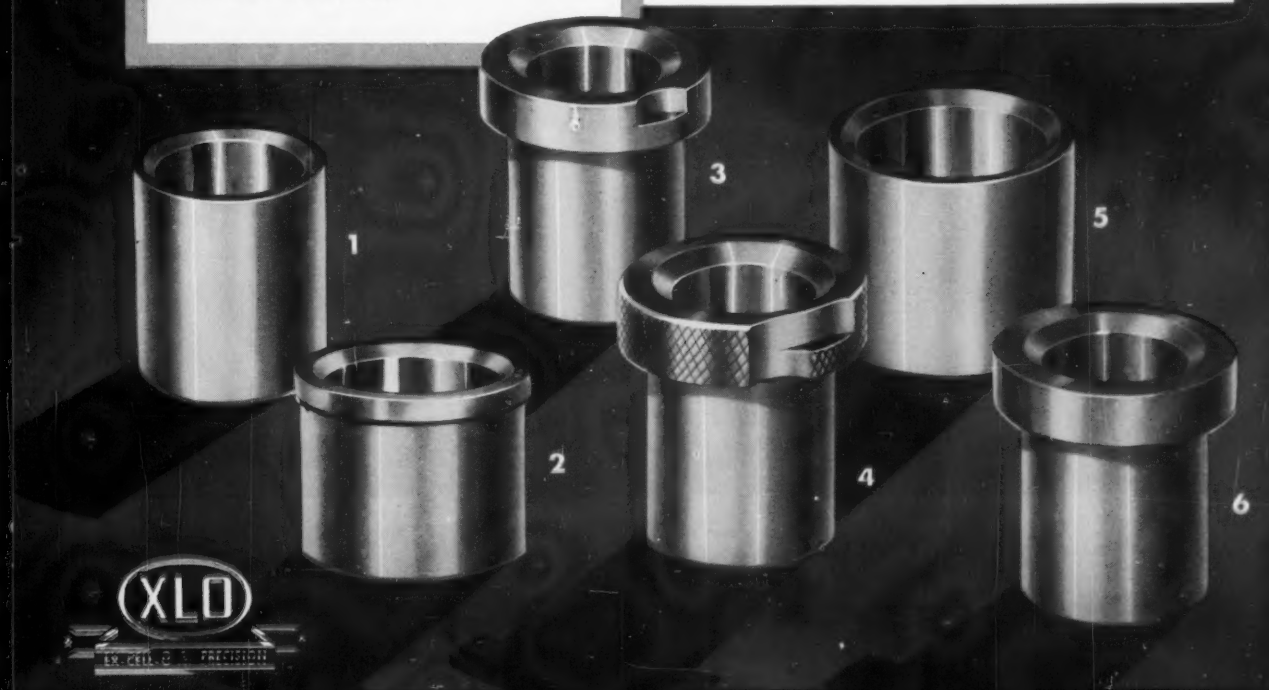
For your engineering and purchasing files: The complete Bushing Guide. Pictures and describes A.S.A. standard bushings, lists hundreds of Ex-Cell-O bushings available from stock. Write for as many copies as you need.

EX-CELL-O
CORPORATION

DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES
CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS
AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

56-12



News OF THE INDUSTRY

California

IRA J. KAAR has been elected to the newly created position of vice-president and engineering director for the Hoffman Electronics Corporation, Los Angeles, Calif. Prior to his appointment, he was manager of the engineering department of the General Electric Co.'s electronic division.

HARVEY ALUMINUM, Torrance, Calif., a producer of wrought-aluminum mill products, announces the opening of new engineering offices, located at 1430 Peachtree St., N. W., Atlanta, Ga., and 505 Park Ave., Detroit, Mich. CHARLES D. MENSER has been appointed district sales manager of the Atlanta office.

CLIFFORD PETTERSON has been named sales engineer in the Los Angeles, Calif., area for the Warner Electric Brake & Clutch Co., Beloit, Wis. He joined Warner in 1954. Mr. Petterson is located at 116 S. Euclid Ave., Pasadena.

DIAMONITE PRODUCTS DIVISION, UNITED STATES CERAMIC TILE CO., Canton, Ohio, has selected the MACHINISTS TOOL & SUPPLY CO., 3690 Santa Fe Ave., Los Angeles 58, Calif., to distribute its new line of oxide cutting tools in the metropolitan Los Angeles area.

Illinois and Wisconsin

SCULLY-JONES & CO., Chicago, Ill., manufacturer of precision holding devices, announces the appointment of new distributors in Illinois and Utah. The NELSON & STORM TOOL SUPPLY CO., 2303 11th St., Rockford, and COUCH & HEYLE, 1016 S. Adams St., Peoria, will serve the Rockford and Peoria, Ill., areas. PRODUCTION TOOLS, INC., 559 S. 3rd W., Salt Lake City, Utah, will serve the state of Utah and neighboring counties in Nevada and Wyoming.

WILLIAM WILSON has been appointed to the newly created position of director of research and development at the A. Finkl & Sons Co., Chicago, Ill., manufacturer of die-blocks, forgings, and electric furnace steels. He formerly was supervisor of metallurgy at the Ekco Products Co. and research metallurgist at Armour Research Foundation of the Illinois Institute of Technology.

J. E. WILLIAMS has been appointed vice-president and general manager, and E. A. NAVE, sales manager for fabricated products, of the Western Brass Mills Division, Olin Mathieson Chemical Corporation, New York City. Headquarters for both appointees will be in East Alton, Ill.

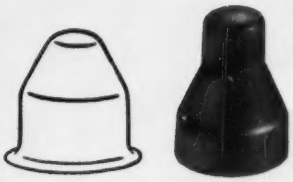
LESTER R. LINDSLEY has been appointed sales manager of P. W. Voss & Associates, Chicago, Ill., representative of the Automatic Transportation Co., located in the same city.

EASTMAN KODAK CO., Rochester, N. Y., has appointed the CHARLES BRUNING CO., INC., 4700 Montrose Ave., Chicago 41, Ill., as national distributor for Verifax copying machines and materials.

KEARNEY & TRECKER CORPORATION, Milwaukee, Wis., has elected J. ROBERT JONES vice-president in charge of sales and has appointed H. W. KIPPERS and CARL F. ENROTH division sales managers. Mr. Jones has spent seventeen years with the company in various sales capacities and was general sales manager for the past year. Mr. Kippers joined the company in 1939. In his present position, he will be in charge of sales for the standard machinery

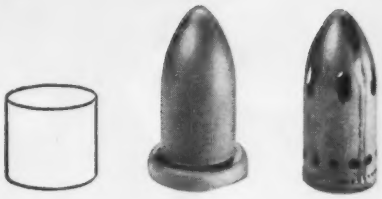
(Continued on page 254)

(Left to right) J. Robert Jones, new sales vice-president, and H. W. Kippers and Carl F. Enroth, new division sales managers, Kearney & Trecker Corporation.



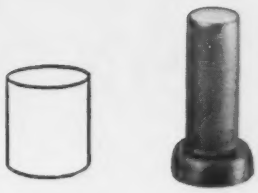
PREFORM 1 11/16" dia. 1 5/16" high
FINAL FORM 1 11/16" dia. 2 1/4" high

2 OPERATIONS plus anneal—.032" AMS 5521. Jet engine part formed by redrawing a cup.



PREFORM 3 3/4" dia. 3 1/4" high
FINAL FORM 2 7/8" dia. 5 1/8" high
PREVIOUS METHOD

2 OPERATIONS—.043" AMS 5540. Jet engine part formed by redrawing a cup. Part at right shows previous forming method of welding two stamped sections together.

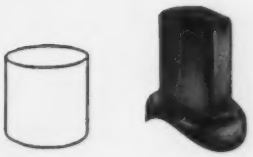


PREFORM 1 1/2" dia. 1 3/4" high
FINAL FORM 1 5/16" dia. 2 3/8" high

2 OPERATIONS—.020" Hy Mu 80. Part formed by redrawing a cup.

Hydroforming

takes less time, less dollars to form tough shapes, tough metals



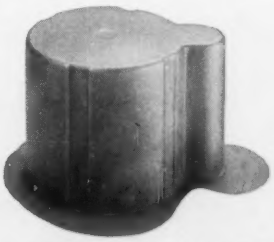
PREFORM 1 3/8" dia. 1 1/4" high
FINAL FORM 1 3/8" long 1/2" wide 1 1/2" deep

2 OPERATIONS plus anneal—.025" Brass. Instrument cover formed by drawing a cup into the final rectangular shape.

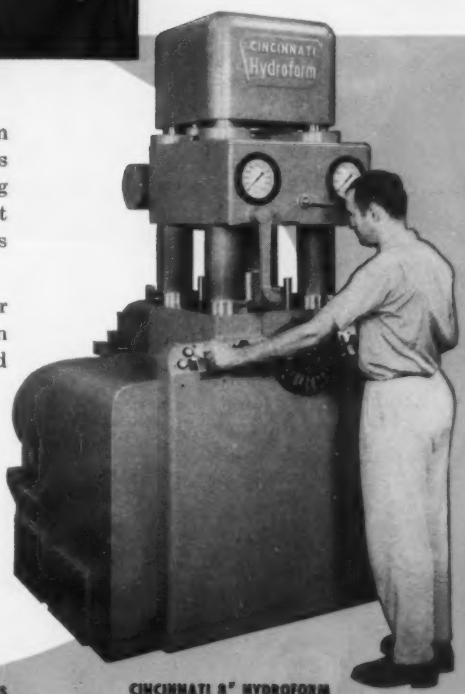
■ Shown here are several parts drawn on Cincinnati Hydroform machines. These range from tough shapes of ductile materials to less complex shapes of harder-to-work alloys. In each instance, Hydroforming substantially reduced the number of operations required to form the part conventionally . . . used simple tooling, costing from 25% to 90% less than conventional tools . . . and produced a part of higher quality.

These advantages—better parts, in fewer operations, at lower costs—can be yours by Hydroforming. Let a Process Machinery Division field engineer give you full details. For a description of the process and specifications of the six machine sizes, write for Bulletin M-1908.

1 OPERATION—.030" Brass. Automotive detail.



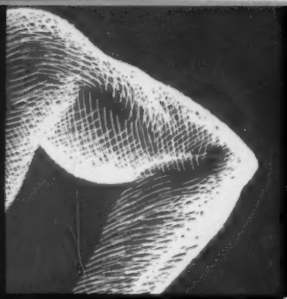
1 OPERATION—.034" CRS, deep-drawing quality. Previous forming method required drawing the can, cutting a slot in the wall and welding on the protruding section.



CINCINNATI 8" HYDROFORM
Also built in 12", 19", 23", 26" and 32" sizes.

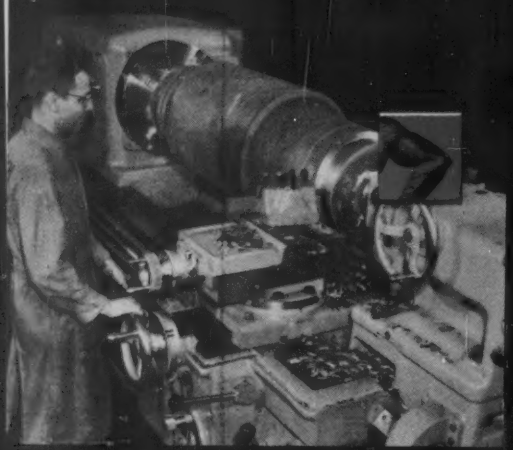
CINCINNATI **Hydroform**

PROCESS MACHINERY DIVISION
THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO, U. S. A.



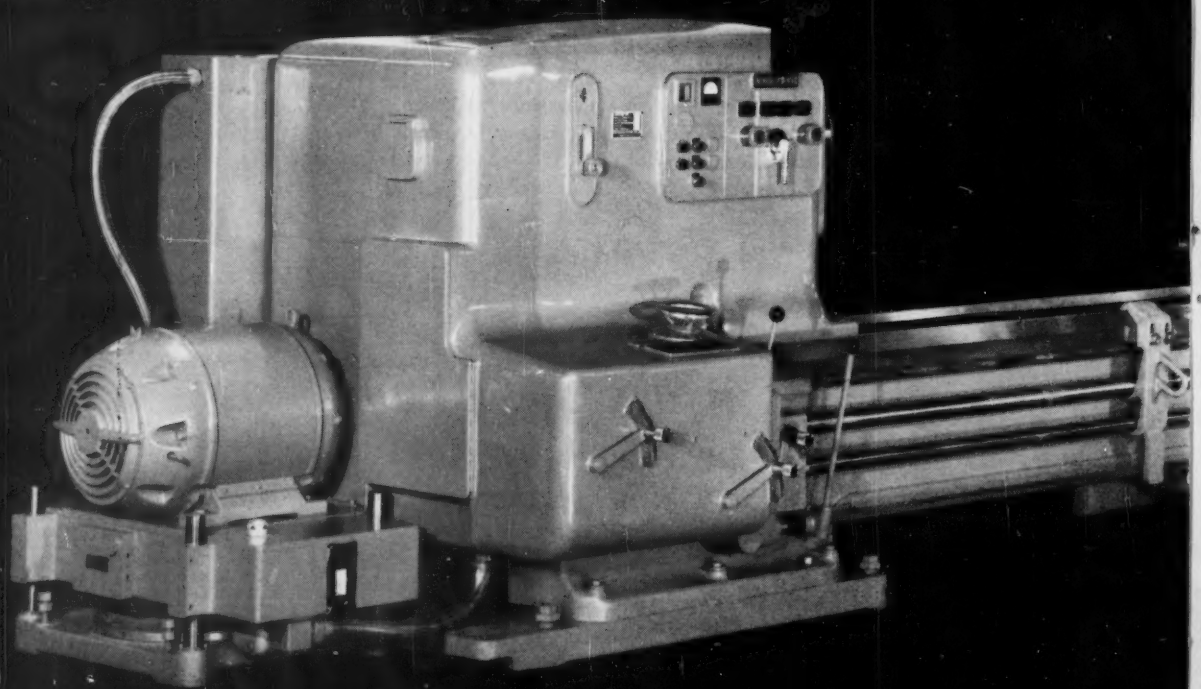
BRAWN

BRAINS



The MONARCH SERIES 90 DYNA-SHIFT HEAVY-DUTY LATHE – Model 2500: Clearance diameter —40″ . . . Swing over cross slide 25″. **Model 2501:** Clearance diameter—44″ . . . Swing over cross slide 31″. **Model 2502:** Clearance diameter—48″ . . . Swing over cross slide 36″.

When progressing from diameter to diameter, speed is changed in a few seconds with the flick of *one* dial. The *machine* calculates each speed and changes speed automatically. And the wide available range assures selection of the *right* speed for the diameter to be turned.



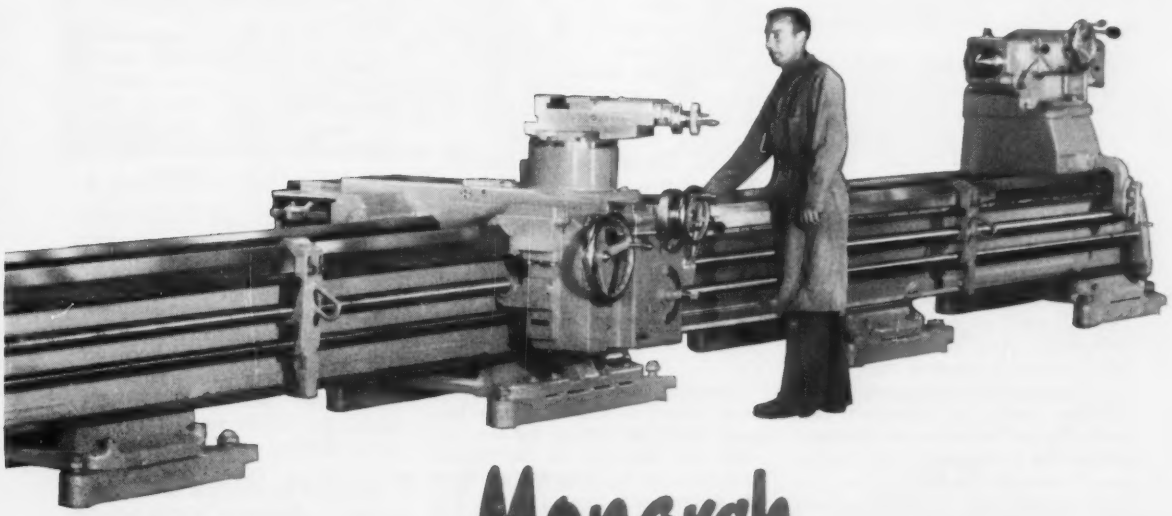
. . The Monarch Heavy-Duty Dyna-Shift

In a class by itself! Just set the work diameter indicator. In a flash, the exclusive Dyna-Shift drive headstock calculates and delivers the ideal spindle speed (36, from 6 to 750 RPM).

You get strength and power to match the brains. The equivalent of 60 H.P. gives this lathe the power to break and the speed to burn any carbide tool. And the massive design supports the heaviest of cuts.

Now, you can use carbide tooling to its ultimate advantage, with metal removal rates up to 120 cubic inches per minute, turning alloy steel. Always used at proper cutting speed, you get the ultimate in productiveness, maximum tool life, and close accuracy.

Here's a machine you've got to know about, and our twenty-four page illustrated booklet #1601 tells you in detail. Just ask . . . The Monarch Machine Tool Company, Sidney, Ohio.



Monarch

ACCURACY • ECONOMY • LONG LIFE •

TURNING MACHINES

FOR A GOOD TURN FASTER . . . TURN TO MONARCH

division. Mr. Enroth will manage sales of the special machinery division, having been a sales engineer in that division for the past three years.

H. R. GODFREY, JR., has been appointed assistant to the general manager, general products division of the Allis-Chalmers Mfg. Co., Milwaukee, Wis. Mr. Godfrey has been a specialist in the chemical and petroleum section of the company's New York district office since 1951. Prior to that, he was an assistant engineer in the centrifugal pump department for several years.

W. W. HIGGINS has been appointed chief engineer of the A. O. Smith Corporation, Milwaukee, Wis. Until recently, Mr. Higgins was director of engineering at the corporation's Permaglas Division in Kankakee, Ill. He joined A. O. Smith in 1930.

R. R. STAMM has been appointed assistant sales manager by the Superior Steel Products Corporation, Milwaukee, Wis. He formerly was in charge of sales engineering.

Kansas and Colorado

WELDON D. WILLES has been named assistant to the president of the Locomotive Finished Material Division, Atchison, Kans., recently acquired by the Rockwell Mfg. Co., Pittsburgh, Pa. Mr. Willes' chief assignment will be to coordinate and integrate Rockwell products into existing production at the Locomotive Finished Material Division.

WESSON CO., Detroit, Mich., has appointed the JARVIS SUPPLY CO., INC., 2180 E. 40th Ave., Denver 5, Colo., as distributor for its line of carbide metals and cutting tools in Colorado.

Michigan

VICKERS INCORPORATED, Detroit, Mich., has named DUNCAN GARDNER director of research and development. Base of operations for Mr. Gardiner's research staff is the new Vickers engineering and administration center in suburban Detroit. His staff includes an electronic section for investigation and analysis of electrohydraulic devices. LES HAISEN has been appointed manager of a new western Michigan branch sales office, with headquarters at 946 Cherry St., S. E., Grand Rapids, Mich.

Joseph P. Chayka, chief engineer, Detroit Broach & Machine Co.

DETROIT BROACH CO., INC., Rochester, Mich., has changed its name to DETROIT BROACH & MACHINE CO. The change stems from the company's increasing activity as a manufacturer of broaching machines since 1952. JOSEPH P. CHAYKA has been appointed chief engineer. Mr. Chayka has a background in the broaching industry as a machine and fixture engineer.

CARBOLOY DEPARTMENT of GENERAL ELECTRIC CO. has been renamed the METALLURGICAL PRODUCTS DEPARTMENT in keeping with the company's emphasis on specialty metals development and manufacture. Headquarters will remain in Detroit, Mich. BRUCE M. SHEFFER, formerly programming and planning coordinator of the Mercury Division, Ford Motor Co., has been appointed manager of advance manufacturing engineering.

WALL COLMONOY CORPORATION, Detroit, Mich., has completed new foundry facilities for producing hardfacing alloys. The plant has a complete line of molding equipment, electric melting furnaces, and production and packaging machinery for welding rods, electrodes, and powder.

HERBERT GEITTMAN, JR., has been placed in charge of development effort on castings for the machine tool industry by the Climax Molybdenum Co., New York City. Mr. Geittman is located at the Detroit, Mich., office. Before joining Climax as a cast-iron specialist, he was foundry manager of Richmond Foundry & Mfg. Co.

FORMSPRAG CO., Van Dyke, Mich., is doubling its manufacturing floor space with a new addition to its plant, now under construction. The company supplies aircraft and automobile industries with sprag clutches for over-running, backstopping, and indexing applications.

KENNETH R. FISHER has been appointed president of the Super Tool Co., Detroit, Mich., a subsidiary of Van Norman Industries, Inc. Mr. Fisher has been connected with Super Tool Co. for eight years in the capacity of sales manager and executive vice-president.

PIONEER ENGINEERING & MFG. CO., Detroit, Mich., announces the opening of branch offices at 228 Leo St., Dayton, Ohio; 100 King St., Alexandria, Va.; and 9 Arnold St., Toronto 14, Canada. S. PAUL BURNS has been named chief engineer of the company.

REPUBLIC STEEL CORPORATION, Cleveland, Ohio, announces the appointment of the HURON STEEL CO., 2701 23rd St., Detroit, Mich., as distributor of Enduro cold-finished stainless steels in the Detroit area. FRANK GREMEL will be Huron's stainless-steel specialist.

SQUARE D CO., Detroit, Mich., has promoted JOHN D. LEITCH to vice-president in charge of engineering. A. H. MYLES has been appointed chief engineer of the Electric Controller & Mfg. Co., Cleveland, Ohio, a Square D division.

WALLACE S. BERRY has been appointed director of research for the automotive division of the American Motors Corporation, Detroit, Mich. Mr. Berry, formerly the division's chief mechanical engineer, held the same post with Nash Motors.

VALENITE METALS CORPORATION, Madison Heights, Mich., a producer of tungsten-carbide tips and tools, is undertaking an expansion program that will triple its present facilities.

ROBERT L. GIBBS has been promoted to general sales manager of the Mueller Brass Co., Port Huron, Mich., Mr. Gibbs was formerly assistant general sales manager.

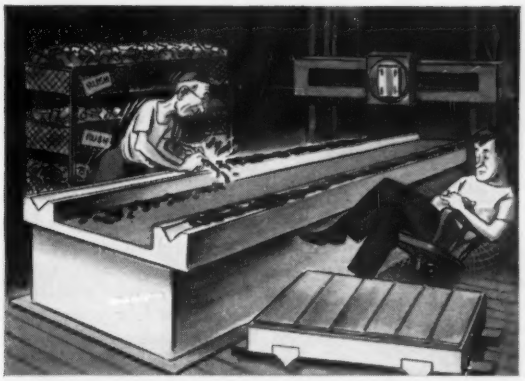
RONALD JENKINS has been named assistant advertising manager of the Simplicity Engineering Co., Durand, Mich.

(Continued on page 256)

1. Cures "stick-slip" or "jumpy table". When a table gets the "shakes", especially after it has just reversed or when the load is heavy and the speed slow, it's probably suffering from "stick-slip". Remedy—Sunoco Way Lubricant®. Special polar compounds in Sunoco Way Lubricant form a friction-reducing film that keeps a table sliding smoothly under all operating conditions.

2. Doesn't squeeze out. When you use a heavy oil as a way lubricant, you must use a lot of oil to maintain a thick enough film. But, heavy oil squeezes out if the table sits in one position very long. You have a tough time getting the table moving again. Protected by the tenacious thin film formed by Sunoco Way Lubricant, the machine can be idle for a week and it will start easily.

WHY SUNOCO WAY LUBRICANT CAN HELP CURE YOUR MACHINING PROBLEMS



3. Protects expensive ways. Badly scored or pitted ways, caused by inadequate way lubrication, result in lost production and expensive repairs. The high film strength of Sunoco Way Lubricant eliminates the danger of metal-to-metal contact, the chief cause of scoring and way wear. Excellent metal-wetting and non-corrosive properties eliminate rusting and pitting.

For the lubrication of slides and ways on this machine, we recommend the use of
SUNOCO WAY LUBRICANT
a product of
SUN OIL COMPANY

4. Approved by more than 55 machine-tool builders. Every major machine-tool builder has tested Sunoco Way Lubricant. It is always approved. In fact, to assure maximum efficiency of their product, many manufacturers ship a supply of Sunoco Way Lubricant with each machine. We'll be glad to send you the list of manufacturers who have approved Sunoco Way Lubricant.

For more information, see your Sun Representative, or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. M-8.

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY

PHILADELPHIA 3, PA.

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IN CANADA: SUN OIL COMPANY LIMITED, TORONTO and MONTREAL

SUNOCO®

For more information fill in page number on Inquiry Card, on page 241

New England

BERNARD L. CHAPIN has been elected president of the New England Carbide Tool Co., Medford, Mass. This company manufactures a line of carbide-tipped masonry bits and a carbide-jeweled knife sharpener. Mr. Chapin has been with New England Carbide Tool since 1942. He is currently a director of the Cutting Tool Manufacturers Association.

WYMAN-GORDON CO., Worcester, Mass., has appointed GEORGE W. PLUMLY western region sales manager, with headquarters in Fort Worth, Texas. A JOSEPH PEPIN, who has served as chief metallurgist, assumes Mr. Plumly's former post of manager of sales, Worcester division.

NORTON CO., Worcester, Mass., has appointed KENNETH EBBESON abrasive engineer for the metropolitan Boston area. He succeeds SIDNEY B. WETHERHEAD, who has been named to the new post of manager of distributor sales.

ROBERT S. GOODYEAR has been named president of Fenwal Electronics Inc., Framingham, Mass., a new firm making precision thermistors. He formerly held the post of vice-president and chief engineer of Victory Engineering Corporation.

GREENFIELD TAP & DIE CORPORATION, Greenfield, Mass., is acquiring the assets of the chuck division of E. HORTON & SON CO., Windsor Locks, Conn. For the present, manufacturing operations will continue at Windsor Locks, and no immediate changes in sales policies are contemplated.

PRATT & WHITNEY CO., INC., West Hartford, Conn., has promoted EDWARD N. CLARK to assistant to the factory manager of its cutting tool and gage divisions and RALPH WINSPEAR to superintendent of the cutting tool division.

WILLIAM L. MARTIN has been named sales manager of the Potter & Johnston Co., Pawtucket, R. I. He joined the company in 1928 and has served as assistant sales manager since 1949.

MINIATURE PRECISION BEARINGS, INC., Keene, N. H., announces the completion of its Precision Park plant. The facilities were designed and built exclusively for the production of precision ball bearings in the miniature range.

New York and New Jersey

ALLEGHENY LUDLUM STEEL CORPORATION, Pittsburgh, Pa., has opened a new induction vacuum-melting department at its Watervliet, N. Y., works. The facility is being utilized temporarily for research and development. It is expected to be converted to a regular production status when present research studies are completed. The new facility will complement the consumable-electrode vacuum-remelting department installed at the same location last year.

LOEWY-HYDROPRESS DIVISION of BALDWIN-LIMA-HAMILTON CORPORATION, New York City, announces the appointment of EDWARD L. HRADESKY as sales coordinator for its guided missile program. Mr. Hradesky's past Loewy assignments have included management of site activities and press installations. EDWARD J. DOOLITTLE, named a field sales engineer, will cover Ohio, West Virginia, and Kentucky. His headquarters will be in the company's Cleveland, Ohio, office.

DOUGLAS C. CUNNINGHAM has joined the Standard Gage Co., Inc., Poughkeepsie, N. Y., as sales manager. He was formerly assistant master mechanic in the Allison Division of the General Motors Corporation and district sales manager of the Middle Atlantic states for Kennametal Inc. In his new capacity, he will have supervision of branch offices and relations with manufacturers' representatives.

HOUDAILLE INDUSTRIES, INC., Buffalo, N. Y., has acquired the assets, and will continue the business of, the WALES-STRIPPIT CORPORATION, North Tonawanda, N. Y. Wales-Strippit manufactures interchangeable punching tools and sheet-metal machinery. Product lines will be expanded by Houdaille, which has also purchased trade names and copyrights.

FRED L. SHANKLIN has been appointed president of Union Carbide Ore Co., a division of the Union Carbide and Carbon Corporation. He succeeds F. S. HAGGERSON, who is resigning for reasons of health. Mr. Shanklin started with the parent company in 1934. He last held the position of vice-president and general manager of the Ore Division.

LOUIS D. MARTIN, for thirty years a gear engineer for the Eastman Kodak Co., has retired to open his own gear consulting business at 303 Granite Building, Rochester 4, N. Y.

ALCO PRODUCTS, INC., Schenectady, N. Y., has named GIBNEY-DECOT CORPORATION, 2107 Kennington Ave., Buffalo, N. Y., as its exclusive representative in New York and northern Pennsylvania.

PHIL ARNOLD, vice-president of the Garlock Packing Co., Palmyra, N. Y., has retired after forty-eight years of service in a succession of sales capacities.

Stanley Lambert, a vice-president and sales manager of Kurt Orban Co., Inc.

STANLEY LAMBERT has been elected a vice-president and sales manager of the steel division of the Kurt Orban Co., Inc., Jersey City, N. J., steel and machine tool importers. For the past four years, Mr. Lambert has been sales representative for a group of French steel mills.

BIJUR LUBRICATING CORPORATION, Rochelle Park, N. J., is expanding its manufacturing facilities at Bennington, Vt. An extension to the existing structure will also house engineering groups devoted to product test and quality control work.

Ohio

LINCOLN ELECTRIC CO., Cleveland, Ohio, is undertaking an $8,000,000 expansion of its plant capacity for manufacturing arc-welding machines and electrodes. The entire project is planned for completion within the next three years. The company is also building new plants in France and Australia

GEARS *that keep* AMERICA *on the* GO!

In vehicles of almost every description—from boats to heavy farm machinery—you'll find flywheel ring gears, transmission gears, differential drive gears, and other gears that are designed, engineered, and manufactured by Automotive Gear Works.

If your product uses gears for power transmission, it may pay you to look into the popularity of gears manufactured by Automotive Gear Works—and learn how we serve as the "gear department" for so many leading manufacturers. Why not write today for further information?

DOUBLE DIAMOND TRADE MARK GEARS

FOR AUTOMOTIVE, FARM EQUIPMENT AND GENERAL INDUSTRIAL APPLICATIONS
GEAR-MAKERS TO LEADING MANUFACTURERS

Automotive Gear Works, inc.

ESTABLISHED IN 1914 RICHMOND, INDIANA

SUBSIDIARY OF EATON MANUFACTURING COMPANY

to replace present plants in those countries and is adding to its Canadian plant.

ROLL FORMED PRODUCTS CO. and HYNES STEEL PRODUCTS CO., both of Youngstown, Ohio, have appointed JOHN W. MCPARLAND as their representative in northwestern Ohio, northern Indiana, and Michigan. Mr. McParland's headquarters will be in Toledo, Ohio. WILLIAM P. COOPER, former representative in the territory, has been transferred to the main offices at Youngstown.

MACON JORDAN has been appointed product manager for tool steel sales in the Cincinnati area by the Solar Steel Corporation, Cleveland, Ohio. He had previously been a representative for Universal Cyclops Steel Corporation and Firth Sterling, Inc.

A. R. ATTEBURY has retired as New York district manager for Timken Roller Bearing Co.'s Steel and Tube Division. The Canton, Ohio, offices are retaining Mr. Attebury as a sales consultant on pressure tubing.

CINCINNATI MILLING MACHINE CO., Cincinnati, Ohio, announces the election of CHARLES M. REESEY and ALBERT H. DALL as vice-presidents of its sales subsidiary, Cincinnati Milling and Grinding Machines, Inc. Mr. Reesey has been advertising manager since 1934. Mr. Dall, currently director of standard machine tool engineering, spent many years on research and design work for the parent company.

E. L. Ritter (left) and David A. Wallace, vice-presidents of engineering and sales, respectively, Cincinnati Lathe & Tool Co.

CINCINNATI LATHE & TOOL CO., Cincinnati, Ohio, announces the election of E. L. RITTER as vice-president in charge of engineering and DAVID A. WALLACE as vice-president in charge of sales. With the company since 1945, Mr. Ritter has directed the engineering and development of the newest lathe and drill lines. Mr. Wallace has been with the company since 1949, most recently holding the position of sales manager.

HYDRAULIC PRESS MFG. CO., Mount Gilead, Ohio, has merged with the KOEHRING CO., Milwaukee, Wis., and will be operated as a division of the latter company. H-P-M manufactures metalworking presses, plastic injection-molding and die-casting machines, hydraulic components, and metal baling and steeping presses.

DONALD E. PIERCE has been promoted to manager of the equipment sales department of Brush Electronics Co., Cleveland, Ohio. He joined the firm in 1953 as a recording systems salesman.

CLEVELAND CAP SCREW CO., Cleveland, Ohio, is erecting a plant and office building in the southeast section of that city. The new office facilities will house executive and sales personnel.

A. H. DAVIS, works manager of the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio, has retired. He joined the firm in 1935 as assistant works manager.

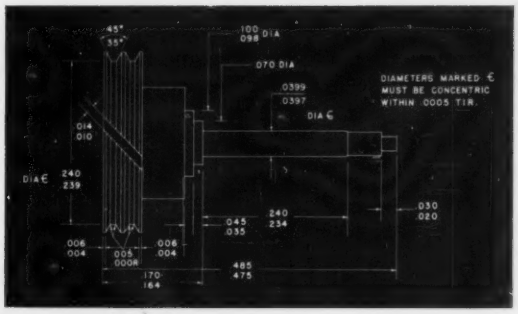
CLARE R. KUBIK, executive vice-president of the Motch & Merryweather Machinery Co., Cleveland, Ohio, is currently abroad, studying industrial conditions in Europe.

Charles M. Reesey (left) and Albert H. Dall, vice-presidents of Cincinnati Milling and Grinding Machines, Inc.

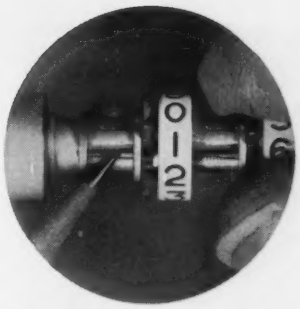
Pennsylvania

DAVID P. HUGHES has been promoted to chief metallurgical engineer of the Latrobe Steel Co., Latrobe, Pa. He will be responsible for activities of the metallurgical laboratory, such as metallurgical investigations, instruction of sales trainees, and technical advice to service engineers. PHILIP E. GORDON becomes manager of the Los Angeles, Calif., sales district. He was formerly a sales representative in the Detroit, Mich., office.

(Continued on page 260)



Inspection of incoming precision shafts took 10 to 15 minutes each by mechanical gaging—involved concentricity, diameters, shoulder locations, and other tough-to-measure dimensions to tolerances of .0002". Doing the work on a Kodak Contour Projector cut time to 2 to 3 minutes per shaft.



The problem was to check many small calculating machine parts averaging about 13 critical dimensions for each with shapes mostly complex. With carefully engineered mechanical gages, inspection time averaged 50 seconds each. Optical gaging on a Kodak Contour Projector brought the average down to 12 seconds.

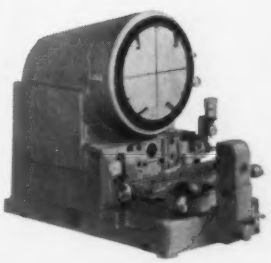
Spacing the parallelism of a special tuning condenser for electronic test equipment had to be held to very close tolerances. "Use of the Kodak Contour Projector," the company reports, "permits economical measurements of parallelism to an accuracy impossible to obtain by other methods."

On a flexible rubber-like part, rejects ran as high as 30%. By using a Kodak Contour Projector to measure the parts and then plotting results by statistical quality control methods, production changes were made that resulted in rejects dropping from 30% to less than ¼ of 1%. Optical gaging eliminated distortion of the part while gaging, and proved 4 to 5 times faster than usual methods.

One instrument inspects these varied parts

Here is another economy optical gaging can provide: switching from one part to a second part requires only a change of chart and fixture. You still use the same basic instrument. And with a Kodak Contour Projector, the variety of parts you can check is almost without limit. Here's why:

1. *Capacity*—Screen size on an optical comparator does not restrict the size of parts you can handle, for multiple-position fixtures allow the handling of parts larger than the screen itself. What's important is the staging area—and Kodak's unique relay lens provides uniform ample clearance regardless of magnification. The distortion-free image lets you measure anywhere on the viewing screen. The choice of lenses, of horizontal or vertical projection, and of surface or shadow illumination gives you the greatest possible flexibility.
2. *Ease of operation*—Kodak Contour Projectors are designed for maximum speed and minimum operator training. The bright screen image reduces fatigue, lets you use the instrument in normal room light. Images are erect and unreversed at all magnifications. Finger-tip controls are within convenient reach of the operator.
3. *Optical stability*—The adjustment-free optical elements on Kodak Contour Projectors eliminate the need for operator adjustments. Rigidly mounted lenses and mirrors maintain alignment and position. Rugged construction withstands rough and heavy use.



Whether you are now using optical gaging or just considering it, you should have a copy of the booklet, "Optical Gaging with Kodak Contour Projectors." It gives complete details on Kodak optical gaging equipment and how it can work for you. Write to *Special Products Sales Division.*

EASTMAN KODAK COMPANY, Rochester 4, N. Y.

the KODAK CONTOUR PROJECTOR

Kodak

Leonard H. Clark, assistant to the vice-president, sales, Standard Pressed Steel Co.

LEONARD H. CLARK has been named assistant to the vice-president, sales, of Standard Pressed Steel Co., Jenkintown, Pa. He will coordinate sales promotion, advertising, and market research. Previously, Mr. Clark was Syracuse, N. Y., district sales manager.

LEEDS & NORTHRUP Co., Philadelphia, Pa., announces the appointment of G. LUPTON BROOMELL, JR., as assistant director of engineering, acting head of engineering and inspection departments, and member of the executive operating committee. He succeeds JOHN W. HARSCH, director of engineering, who is retiring. Mr. Broomell has been chief engineer for the past eighteen months.

FIRTH-LOACH METALS, INC., McKeesport, Pa., has elected WILLIAM J. LOACH president. Prior to his election, Mr. Loach, a cofounder of the company, was executive vice-president. He succeeds L. GERALD FIRTH, who continues as director. M. A. CANCELLIERE will become vice-president and, in addition, remain chairman of the board.

BIRDSBORO STEEL FOUNDRY & MACHINE Co., Birdsboro, Pa., has diversified its interests by acquiring UNIVERSAL MAJOR ELECTRICAL APPLIANCES, INC., Baltimore, Md. MIRAWAL CORPORATION, Universal Major's manufacturing division, produces porcelainized metal sheeting for interior and exterior walls.

REED D. HOLT has joined Blaw-Knox Co., National Alloy Division, Blawnox, Pa., as a sales representative. Mr. Holt will contact industrial consumers of high-temperature and corrosion-resisting alloy castings in western Pennsylvania, eastern Ohio, and West Virginia.

LAWRENCE C. CONNOLLY has been appointed sales and service engineer for the Middle Atlantic states by the Wall Colmonoy Corporation. His offices will be located in Morrisville, Pa.

New Books and Publications

THOMAS' REGISTER OF AMERICAN MANUFACTURERS (1956). 9550 pages, 9 by 14 inches. Forty-sixth edition, published by the Thomas Publishing Co., 465 Eighth Ave., New York 1, N. Y. Price, $15.

Informative purchasing encyclopedia covering more than 70,000 products in all lines of manufacture in the United States. Published in five volumes.

The first three volumes list names and addresses of manufacturers classified by products. Products are classified not only by generalized groupings but also by specific types so that particular types can easily be found. Manufacturers' names are listed alphabetically under each product and are also arranged by states and cities, thus facilitating selection of products within certain geographical boundaries. All classifications are thoroughly cross-indexed, and a capacity or capital investment rating is made for each firm on each product listing.

An alphabetical list of manufacturers, branches, subsidiaries, and other data, such as company officials and cable codes, can be found in the fourth volume, which also gives an alphabetical list of trade names, together with export and other miscellaneous information.

Volume V, the index product-finding guide, also serves as an index to advertisers. This volume, being rather thin and readily mislaid or lost, can be replaced at the cost of $1 each as long as the supply is available.

AMERICAN STANDARD 20-DEGREE INVOLUTE FINE-PITCH SYSTEM. (AGMA 273.04 ASA B6.7-1956 for Spur and Helical Gears). 23 pages, 8½ x 11 inches. Published by the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y. Price $1.50.

AMERICAN STANDARD INSPECTION OF FINE-PITCH GEARS. (AGMA 236.04 ASA B6.11-1956) 41 pages, 8½ x 11 inches. Published by the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y. Price $2.50.

Coming Events

SEPTEMBER 17-21—Eleventh International Instrument-Automation Conference and Exhibit sponsored by INSTRUMENT SOCIETY OF AMERICA to be held at the New York City Coliseum. The society, which has its headquarters in Pittsburgh, Pa., has opened temporary offices at 250 W. 57th St. in New York City, from which it will direct the conference and exhibit.

SEPTEMBER 25-28—IRON AND STEEL EXPOSITION to be held in the Cleveland Public Auditorium, Cleveland, Ohio.

SEPTEMBER 27-29—Thirty-third annual meeting and national supervisory development conference of the NATIONAL MANAGEMENT ASSOCIATION to be held at the Sheraton-Jefferson Hotel in St. Louis, Mo.

OCTOBER 8-12—National Metal Congress and Exposition sponsored by the AMERICAN SOCIETY FOR METALS to be held at the Cleveland Public Auditorium and Exhibition Hall, Cleveland, Ohio. Further information can be obtained from W. H. Eisenman, American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio.

November 26-30—TWENTY-SECOND NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING under the auspices of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS to be held at the New York City Coliseum in conjunction with the Society's seventy-sixth annual meeting. As heretofore, it will be under the management of the International Exposition Co.

Important Announcement

by HORTON CHUCK — Since 1851

TO THE METALWORKING INDUSTRY

ON JULY 1ST, 1956, the Horton Chuck Division, Windsor Locks, Connecticut, became an operating Division of Greenfield Tap and Die Corporation, Greenfield, Massachusetts.

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Product Directory

To find headings easily, look for capital letters at top of each page to denote location.

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Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

ABRASIVES
See Discs, abrasive

ABRASIVES, HONING
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.

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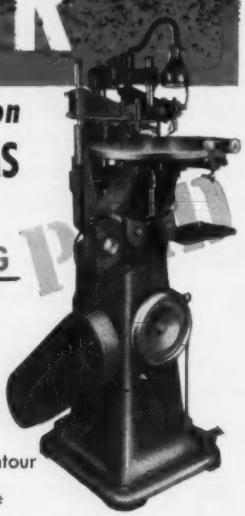

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AIR TOOLS—See Grinders, Pneumatic; Drills, Portable Pneumatic, Etc.

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Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., Carnegie-Illinois Steel Corp. Div., 436 7th Ave., Pittsburgh, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

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Dow Chemical Co., Midland, Mich.

ALLOYS, Non-Ferrous
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Bridgeport Brass Co., Bridgeport, Conn.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

ALLOYS, Zinc
New Jersey Zinc Co., 160 Front St., New York, N. Y.

See Presses, Arbor
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Brown & Sharpe Mfg. Co., Providence, R. I.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Gorton, George Mch. Co., 1110 W. 13th St., Racine, Wis.
Jacobs Mfg. Co., West Hartford, Conn.
Kempsmith Machine Co., Milwaukee, Wis.
National Twist Drill & Tool Co., Rochester, Mich.
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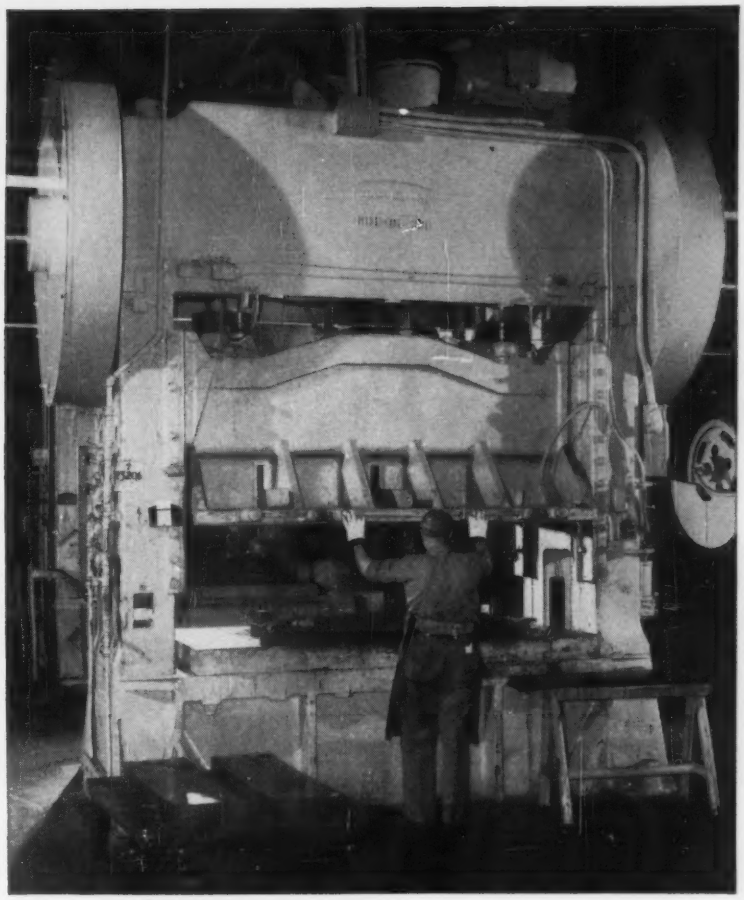
Supreme Products, Inc., 2222 So. Calumet Ave., Chicago 16, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

(*Continued on page 266*)



The Cleveland Double-Crank Press shown here draws more than seven parts for the famous Servel Refrigerator.

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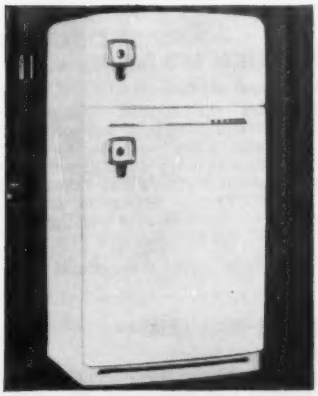

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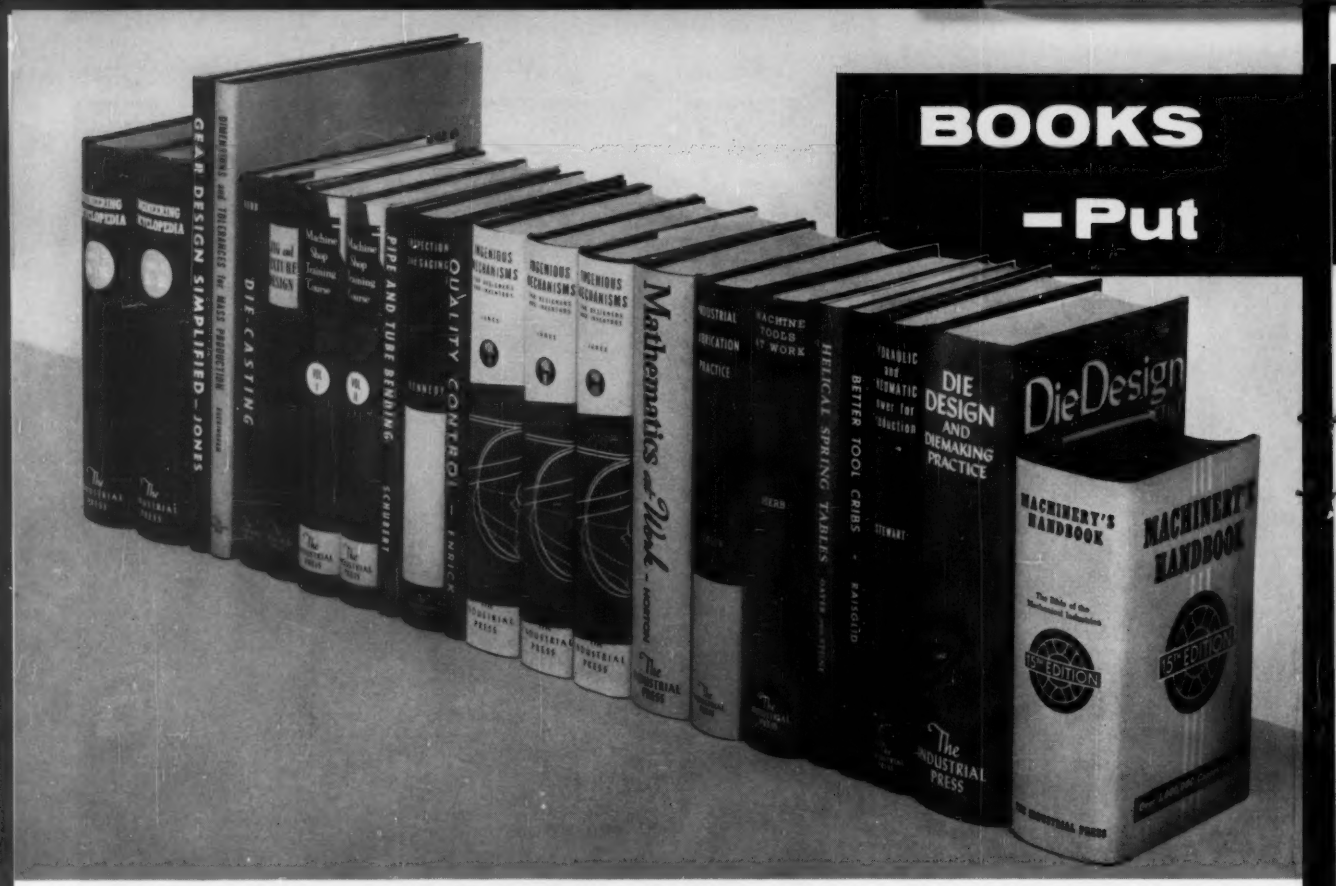

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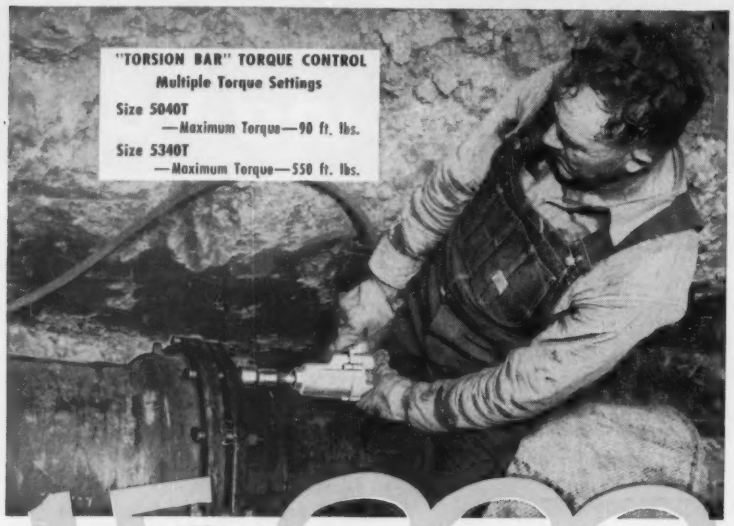

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Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Shenango-Penn Mold Co., Dover, Ohio.

BEARINGS, Lineshaft
Fafnir Bearing Co., New Britain, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Standard Pressed Steel Co., Jenkintown, Pa.

BEARINGS, Needle
Orange Roller Bearing Co., Inc., Orange, N. J.

BEARINGS, Roller
Ball & Roller Bearing Co., Danbury, Conn.
Fafnir Bearing Co., New Britain, Conn.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearings Co., Inc., 541 Seymour St., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio.

BEARINGS, Self Lubricating (Oilless)
American Crucible Products Co., 1395 Oberlin Ave., Lorain, Ohio
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.

BEARINGS, Tapered Roller
Timken Roller Bearing Co., Canton, Ohio.

BEARINGS, Thrust
Ball & Roller Bearing Co., Danbury, Conn.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Fafnir Bearing Co., New Britain, Conn.
General Electric Co., Schenectady, N. Y.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearing Co., Inc., Syracuse, N. Y.
Shenango-Penn Mold Co., Dover, Ohio.
Timken Roller Bearing Co., Canton, Ohio.

BELT SHIFTERS
Standard Pressed Steel Co., Jenkintown, Pa.

BELTING, Transmission
Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia, Pa.

BENCHES, Work, and Bench Legs
Standard Pressed Steel Co., Jenkintown, Pa.

BENDING MACHINES, Angle Iron, Plate, Etc.
Consolidated Mch. Tool Corp., 656 Blossom Rd., Rochester, N. Y.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

BENDING MACHINES, Hydraulic
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Chambersburg Engrg. Co., Chambersburg, Pa.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Hannifin Corp., 501 Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

BENDING MACHINES, Pipe
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Farquhar, A. B., Div. Oliver Corp., York, Pa.

BLAST CLEANING EQUIPMENT
Modern Ind., Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Pangborn Corp., Hagerstown, Md.
Wallis Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

(Continued on page 269)

NEW

THE ONLY

SURFACE GRINDER with a POSITIVE SAFETY SHUT-OFF!

AUTOMATICALLY PREVENTS OVER-SPEEDING OF GRINDER
The automatic safety device stops the grinder if it overspeeds due to any reason.

PLUS THESE OTHER COST-SAVING OPERATING ADVANTAGES:

- Handles can be set at 90° or 120° for close corner work and operator comfort . . . another Ingersoll-Rand FIRST!
- A responsive governor insures maximum cutting speed and minimum air consumption regardless of load.
- Single point lubrication, double-sealed wheel bearings, large oil reservoir for long life, low cost operation.
- Top of tool is flat for easy pressure application.
- Available in 2 Models and 4 speeds as follows:

  Speeds: 3100—4100—4500—and 6000 rpm.

  Size 41F with push-locking throttle for constant operation.

  Size 41FX with self-closing, safety type throttle.

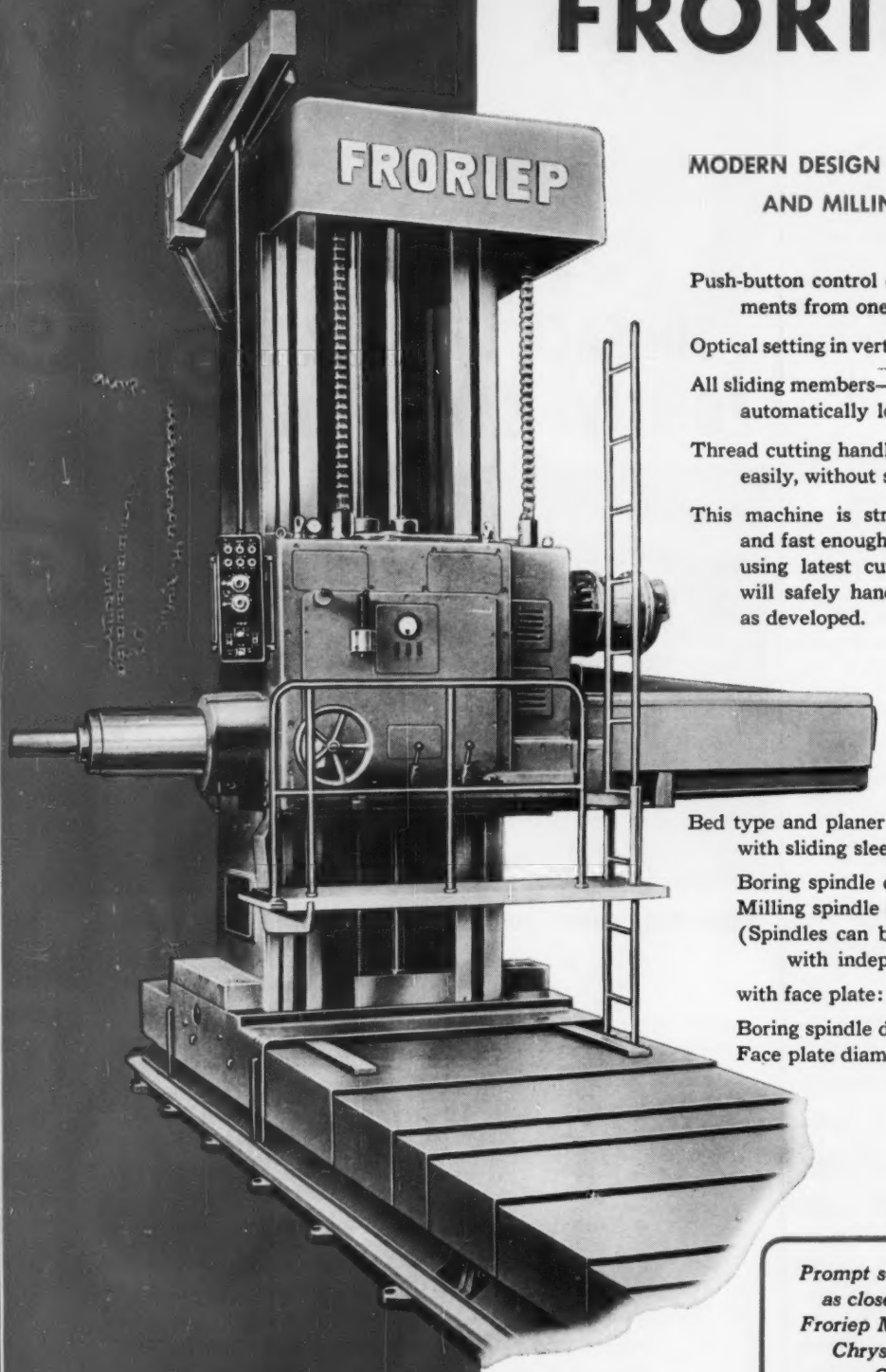
Ask for a demonstration of this new safety grinder in your shop.

8-343

Ingersoll-Rand

11 Broadway, New York 4, N.Y.

FRORIEP



MODERN DESIGN MAKES BORING AND MILLING FASTER AND EASIER

Push-button control of speeds, feeds, and movements from one movable pendant.

Optical setting in vertical and transverse position.

All sliding members—
automatically locked in position.

Thread cutting handled
easily, without special changes.

This machine is strong enough, rigid enough and fast enough for maximum performance using latest cutting tool techniques, and will safely handle improved cutting tools as developed.

Bed type and planer type, large capacities, with sliding sleeve:

Boring spindle diameter from 5⅛ to 8⅞"
Milling spindle diameter from 7⅞ to 15"
(Spindles can be operated simultaneously with independent speeds and feeds.)

with face plate:

Boring spindle diameter from 5⅛ to 10¼"
Face plate diameter from 30 to 51"

Prompt service and spare parts as close as your telephone.
Froriep Machine Service Corp.
Chrysler Building, N. Y.
ORegon 9-3560

COSA — *nationwide sales and service of precision machine tools—from bench lathes to boring mills.*

COSA CORPORATION, 405 LEXINGTON AVENUE, NEW YORK 17, N. Y.

BLOWERS
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

BLUING LAYOUT
Dykem Co., 2303P. N. 11th St., St. Louis 6, Mo.

BLUEPRINT MACHINERY & ACCESSORIES
Wickes Brothers, 512 No. Water St., Saginaw, Mich.

BOILER TUBES
Bethlehem Steel Co., Bethlehem, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

BOLT AND NUT MACHINERY
Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
New Britain Machine Co., New Britain-Gridley Mch. Div., New Britain, Conn.

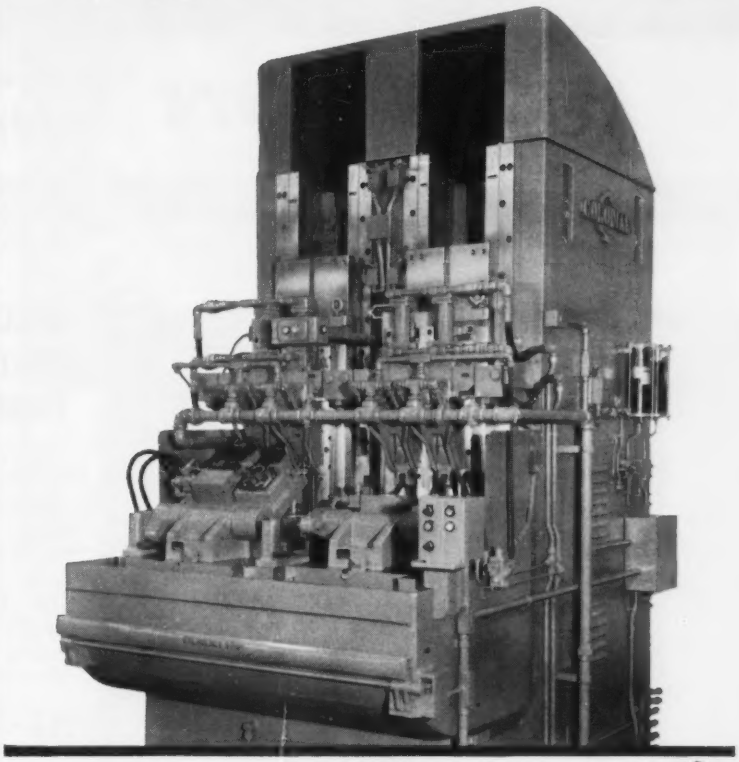
BOLTS AND NUTS
Bethlehem Steel Co., Bethlehem, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Ottemiller, W. H., & Co., York, Pa.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.

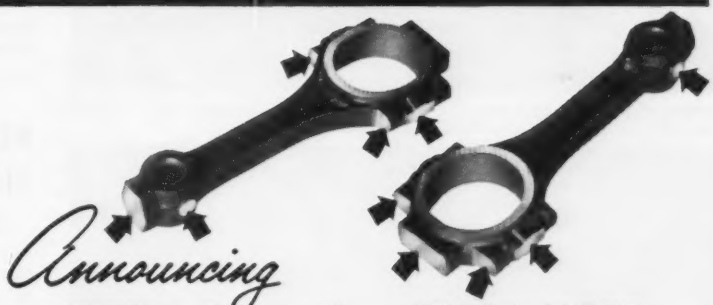
BOOKS, Technical
Industrial Press, 93 Worth St., New York 13, N. Y.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio.

BORING AND DRILLING MACHINES
Baker Bros., Inc., Sta. F, P. O. Box 101, Toledo 10, Ohio.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Wales-Strippet Corp., North Tonawanda, N. Y.

BORING AND TURNING MILLS, Vertical
American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

(Continued on page 271)





Announcing

NEW *ElectroGear* DUAL RAM

Broaching Machine

Automotive connecting rods are being broached at a 450 per hour rate on a new Colonial ElectroGear dual ram broaching machine. Finish on broached surfaces is definitely superior—tool life is longer. Cutting speed is 45 feet per minute.

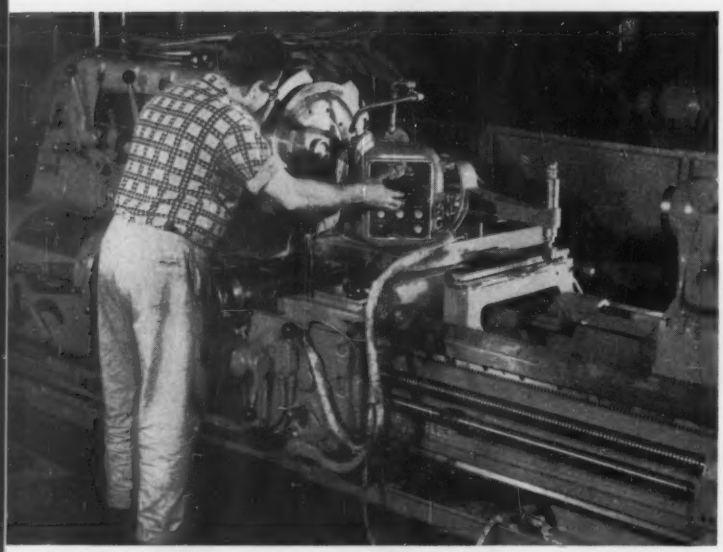
Side by side broaching on each ram (balancing pad and locating pads) produces two completed parts with each cycle of the machine.

New Colonial ElectroGear drive broaching machines are made in dual ram vertical and single ram horizontal models. Your Colonial representative can tell you about the new high in broaching performance that you can get with these machines. Write for information.

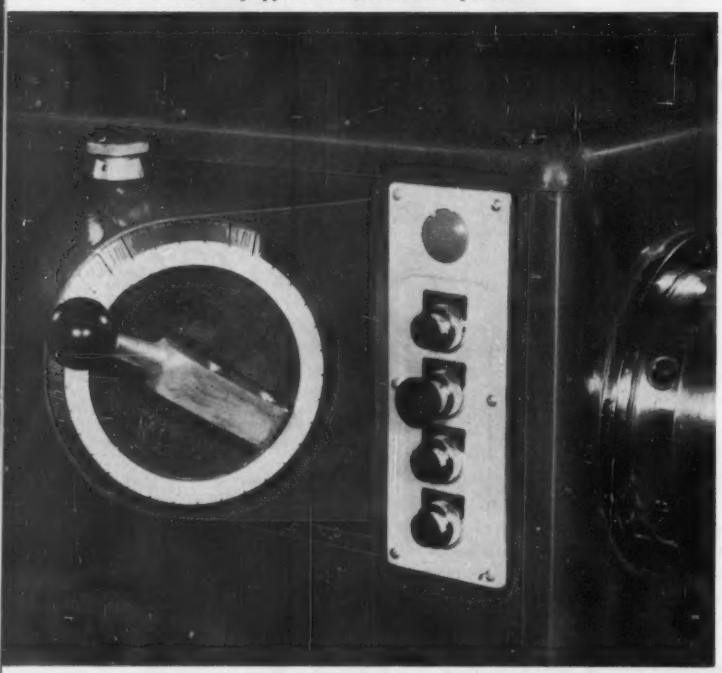
COLONIAL
BROACH & MACHINE CO.
DETROIT 13, MICH.

AXELSON production and maintenance news

AXELSON MANUFACTURING COMPANY / DIVISION OF U.S. INDUSTRIES, INC. 6160 SOUTH BOYLE AVENUE. LOS ANGELES 58. CALIFORNIA



TURBO-JET ENGINE PRODUCTION. Contouring aft side of 125-pound turbine wheel on Axelson lathe equipped with electronic duplicator.



CENTRALIZED HYDRAULIC PRESELECTOR is one of the keys to easier operation and unusual flexibility of the Axelson 2516 heavy-duty lathe. With the preselector, the lathe can be used with equal ease for long-run production or single set-up operations.

ELECTRONIC TRACER CONTROL FEATURED IN JET TURBINE PRODUCTION

Rotating engine parts, which operate under widely fluctuating environmental conditions during high-speed aircraft flight, must be precisely machined so expansion and contraction of the metal will not affect engine performance.

At General Electric's AGT Division, Evendale, Ohio, Axelson lathes equipped with electronic duplicators reproduce turbo-jet engine parts. Using simple, flat templates, the electronic duplicators precisely control the lathes for highly-accurate contour-facing operations. Special carbide-tipped tools are used in the two-stage turning operations on the 28-32 Rockwell, Timken steel turbine rotor wheels. Floor-to-floor time for these two operations is less than an average work day.

NEW 2516 HEAVY-DUTY LATHE SIMPLIFIES OPERATOR CONTROL

Speed selection of 32 different spindle speeds from 11 to 1600 RPM has been greatly simplified in the new Axelson 2516 heavy-duty lathe through the use of a hydraulic preselector.

The operator can preset a new spindle speed while the lathe is in operation, move to the end of the bed and, without returning to the headstock, automatically switch to the preselected speed by operating a lever on the apron.

Speed changes are made through involute clutches; the headstock contains no sliding gears.

For a complete description and detailed specifications on the 2516, the new Axelson 4025 and Axelson Tool Room, Medium-Duty and other Heavy-Duty Lathes, write for bulletins M8-5507 and 5504.

AXELSON

AXELSON MANUFACTURING COMPANY
Division of U. S. Industries, Inc.
6160 SOUTH BOYLE AVENUE
LOS ANGELES 58, CALIFORNIA

BORING BARS

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Ingersoll Milling Mach. Co., 2442 Douglas St., Rockford, Ill.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

BORING, DRILLING AND MILLING MACHINES, Horizontal

(Floor, Planer or Table Types)

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 120 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave., and Penn. R. R. Evanston, Cincinnati, Ohio.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Innocenti Corp., 43 W. 61st St., New York 23, N. Y.
Lucas Mch. Tool Div., New Britain Mch. Co., 12302 Kirby Ave., Cleveland 8, Ohio.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

BORING HEADS

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Mummert-Dixon Co., Hanover, Pa.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

BORING MACHINES

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bryant Chucking Grinder Co., Springfield, Vt.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Wadell Equipment Co., 119 So. Ave., Garwood, N. J.

(*Continued on page 272*)

THE DIES ARE YOURS FREE!

Yes, we do hundreds of stamping jobs without making special tools—and there's a good reason for this. In stamping out laminated shims for over forty years, we've developed much special equipment and tooling unknown in the average stampings house... including an arsenal of blanking dies and punches...and we've acquired unusual production techniques and skills. This equipment and these special skills are at your service without charge.

ROCK-BOTTOM PRICES . . . BY THREE METHODS!

These three separate production techniques are judiciously applied to save you money on your stamping needs!

MACHINE CUT METHOD. Regardless of quantity, we have the method that fits your needs best! For half-a-dozen or a few hundred stampings, our *Machine Cut Method* produces the stampings at amazingly low cost.

SHORT RUN METHOD. As quantities increase, we shift to the *Short Run Method*, with stock tooling and temporary dies—such as the surprisingly low-priced Hecht-type die.

PRODUCTION METHOD. Or we shift to our *Production Method* using high speed self-feeding presses.

For full information, send for our free 12-page booklet "Service in Stampings." And next time you need stampings, why not let us bid—and discover the savings we offer you!

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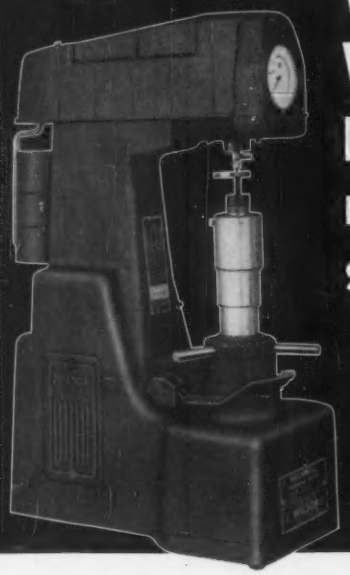
STAMPINGS DIVISION

"ONE PIECE OR ONE MILLION"

3908 UNION STREET • GLENBROOK, CONNECTICUT

ACCO products

Wilson "Rockwell"* Hardness Testers



Why WILSON ROCKWELL means accuracy, speed and economy EVERYWHERE.

8" Capacity
Rockwell Hardness Tester

• WILSON field service is the best we know how to make it. In every industrial area, WILSON offices are well staffed with factory-trained experts who "practically eat and sleep" hardness testers.

These experts help make sure that—

You Get the Hardness Tester You Need

Whether your hardness tester is required for use in laboratory, tool room, inspection department or on the production line, there is a WILSON model to serve you best.

Consultation is as Close as the Phone

Changing work conditions frequently call for different accessories, sometimes a different model of tester. A WILSON expert is never more than a few hours away to make sure that the service you get from your WILSON equipment is all that you expect.

You Get Prompt Service if You Need It

Hardness testers must always operate at peak efficiency. WILSON owners know they can count on WILSON service to make sure that their equipment is always ready.

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A FULL LINE TO MEET EVERY HARDNESS TESTING REQUIREMENT

FULLY AUTOMATIC
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the world's standard of hardness accuracy

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for Better Value

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American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
American Sip Corp., 100 E. 42nd St., New York 17, N. Y.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Kearney & Trecker Corp., Milwaukee, Wis.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.
Wales-Strippet Corp., North Tonawanda, N. Y.

BORING TOOLS

Apex Tool & Cutter Co., Inc., 237 Canal St. Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

BRAKES, Press and Bending

Bath, Cyril Co., Aurora & Solon Road, Solon, Ohio
Bliss, E. W., Co., 1375 Raff Road, S. W. Canton, Ohio.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Machine Co., Bridgeton, N. J.
Hamilton Div. of the Lodge & Shipley Co., Hamilton 1, Ohio.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.

BRASS

American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

BROACHES

American Broach & Mch. Co., Ann Arbor, Mich.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
duMont Corp., Greenfield, Mass.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

BROACHING MACHINE

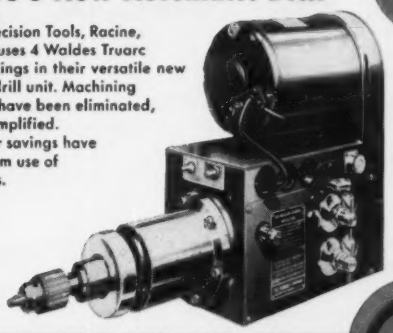
American Broach & Mch. Co., Ann Arbor, Mich.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Detroit Broach Co., P. O. Box 156, Rochester, Mich.
Foote-Burt Co., 130 St. Clair Ave., Cleveland 8, Ohio.

(Continued on page 274)

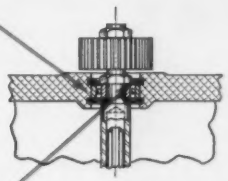
4 Waldes Truarc Rings Cut Costs Drastically, Increase Versatility of Precision Automatic Drill

Dumore's New Automatic Drill

Dumore Precision Tools, Racine, Wisconsin, uses 4 Waldes Truarc Retaining Rings in their versatile new automatic drill unit. Machining operations have been eliminated, assembly simplified. Great labor savings have resulted from use of Truarc rings.

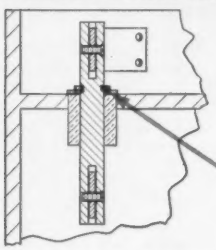


Drive Spindle Assembly



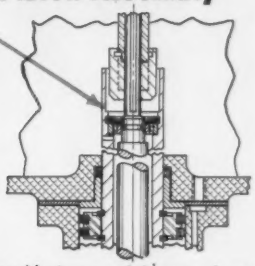
Bearing is held in position by two Waldes Truarc Rings—Standard (Series 5000) and Bowed (Series 5001). Two grooves are turned and housing rough bored in one operation. Alternate method would require at least two additional machining operations. Bowed Truarc ring takes up accumulated tolerances resiliently.

Actuator Lever Shaft Assembly



A Single Waldes Truarc External Retaining Ring (Series 5100) acts as shoulder, holds the lever in position. Labor savings are tremendous—a simple groove cutting operation replaces turning a shoulder, grinding and polishing.

Piston Assembly



Easy assembly is assured by use of one Waldes Truarc Bowed Ring (Series 5001) to lock the bearing to the piston assembly. When unit is to be used in tapping applications, entire spindle assembly can be removed without disassembly.

Whatever you make, there's a Waldes Truarc Retaining Ring designed to improve your product...to save you material, machining and labor costs. They're quick and easy to assemble and disassemble, and they do a better job of holding parts together. Truarc rings are precision engineered and precision made, quality controlled from raw material to finished ring.

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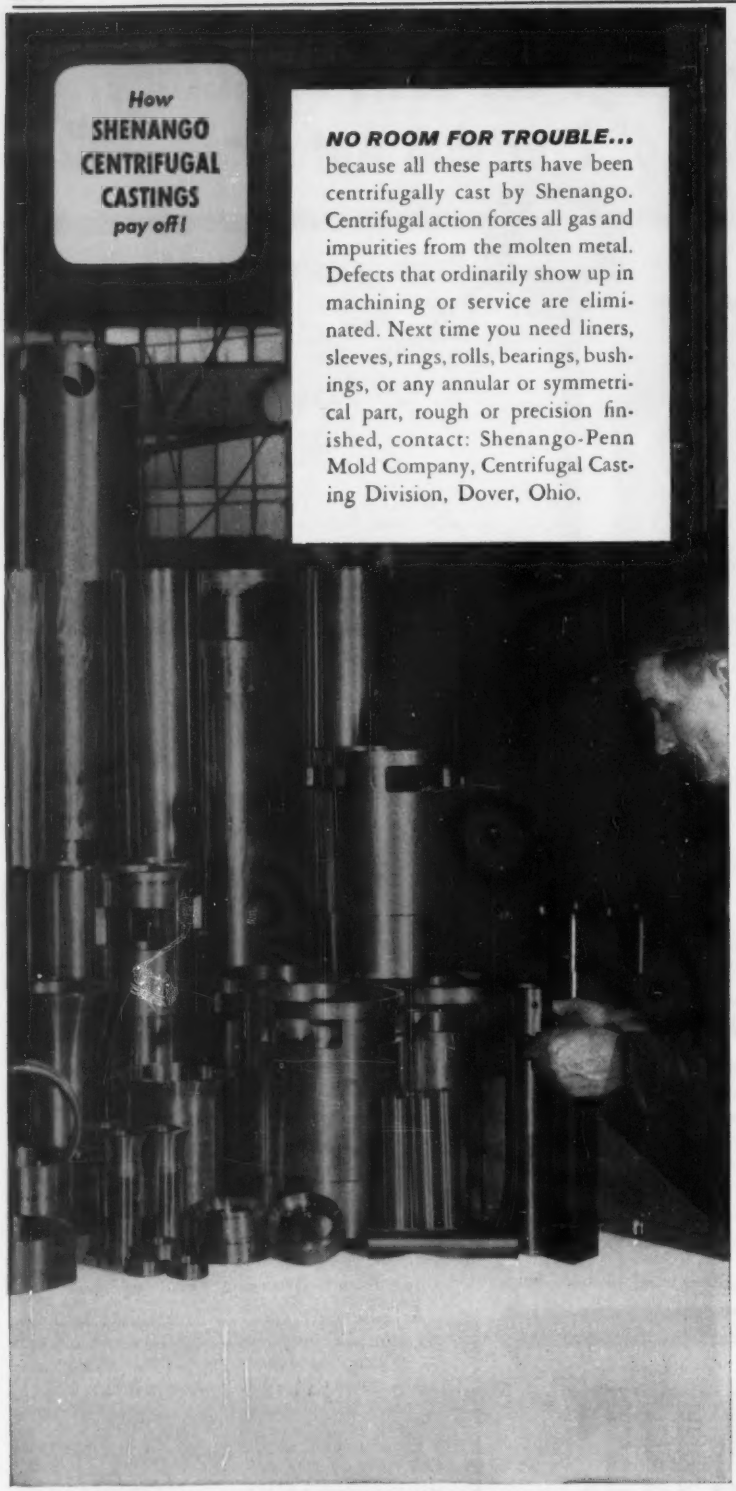
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Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

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American Brass Co., Waterbury 20, Conn.
American Crucible Products Co., 1395 Oberlin Ave., Lorain, Ohio
Bridgeport Brass Co., Bridgeport, Conn.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Mueller Brass Co., Port Huron 35, Mich.

BRUSHES, Industrial, Wire Wheel, Etc.

Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.

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Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

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Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Erie Foundry Co., Erie, Pa.
Lake Erie Engineering Corp., Kenmore Station, Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

BURS

See Files and Burs, Rotary

BUSHINGS, Brass, Bronze, Carbide, Etc.

American Crucible Products Co., 1395 Oberlin Ave., Lorain, Ohio
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
Shenango-Penn Mold Co., Dover, Ohio.

BUSHINGS, Hardened

Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Leland-Gifford Co., 1925 Southbridge St., Worcester, Mass.
U. S. Steel Co., Inc., 436 7th Ave., Pittsburgh, Pa.
U. S. Tool Co., Inc., 255 N. 18th St., Ampere, N. J.

BUSHINGS, Jig

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Universal Engrg. Co., Frankenmuth, Mich.

CABINETS, Tool

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

CALIPERS

Ames, B. C., & Co. (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S. Co., Athol, Mass.

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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sundstrand Machine Tool Co., 2351 11th St., Rockford, Ill.

(*Continued on page 276*)

Schrader 4-way SOLENOID OPERATED VALVE is the heart of the sealing operation shown in this photograph. Hundreds of other Schrader products adapt to almost any manufacturing hookup. A few of them are indicated here in red (Numbers 1 through 6).
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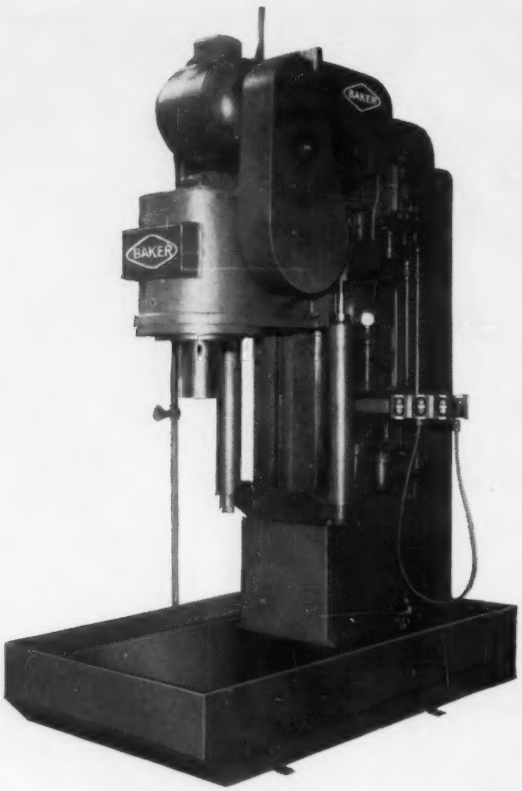

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COMPANY
ADDRESS
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CAM MILLING AND GRINDING MACHINES
American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Landis Tool Co., Waynesboro, Pa.
Rowbottom Machine Co., Waterbury, Conn.

CAMS
Eisler Engrg. Co., Inc., 760 S. 13th, Newark 3, N. J.
Hartford Special Machry. Co., 287 Homestead Ave., Hartford, Conn.
Rowbottom Machine Co., Waterbury, Conn.

CARBIDES, TANTALUM, TITANIUM AND TUNGSTEN
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CASEHARDENING FURNACES
See Furnaces, Heat-Treating

CASTINGS, Aluminum, Brass, Bronze, Magnesium, Etc.
American Crucible Products Co., 1395 Oberlin Ave., Lorain, Ohio
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co. (Brass and Bronze only), Bethlehem, Pa.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Mueller Brass Co., Port Huron 35, Mich.
Shenango-Penn Mold Co., Dover, Ohio.

CASTINGS, DIE
American Brass Co., Waterbury 20, Conn.
Madison-Kipp Corp., Madison, Wisc.

CASTINGS, Iron
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engineering Co., Chambersburg, Pa.
Shenango-Penn Mold Co., Dover, Ohio.

CASTINGS, Steel, Alloys, Etc.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
U. S. Steel Corp., Columbia Steel Co., Div., 436 7th Ave., Pittsburgh, Pa.

CEMENT, Disc Grinding Wheel
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

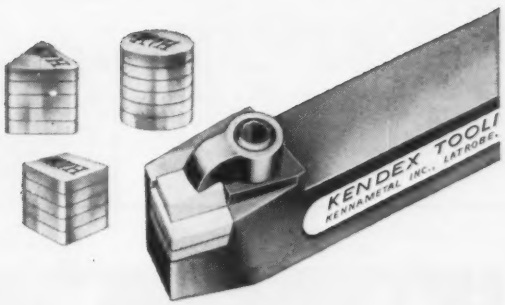
CENTERING MACHINES
Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Machine Works, Front St., and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., Springfeld, Vt.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.
(Continued on page 278)

Here's more proof that KENNAMETAL*

K7H

is the best carbide cutting grade . . .

- ✓ for high velocity machining
- ✓ for cutting heat-treated and high tensile steels



Use Kendex Tooling with turn-over inserts (available in 17 styles and over 200 tools) . . . for lowest cost per cutting edge.

1 "Hard-to-machine" steel part finish bored 4 times faster with better dimensional control and better finish

OPERATION: Machine component of forged high nickel-chromium-tungsten content finish bored on a 62" King Boring Mill to size 38" diameter by 23¼" long, with a .014" feed and 3/16" depth of cut.

OLD TOOLING—Results: A special brazed shear tool with a competitive carbide, operating at 70 sfm, became very dull and produced only a fair finish with a slightly tapered bore.

WITH K7H—Results: A K7H cutting insert on a Kendex KSBL Holder, operating at 300 sfm (four times faster than with the previous competitive carbide), showed very little wear and provided *an excellent finish with a straight bore.*

2 Plunge and rough cutting heat-treated steel

OPERATION: Plunge and rough turning a heat-treated 1045 steel cylindrical machine part, operating at 350 sfm, with a .024" feed and 3/16" to ¼" depth of cut.

OLD TOOLING—Results: Carbides previously used produced only 30 to 35 pieces per cutting edge.

WITH K7H—Results: A K7H throw-away type insert in a Kendex tool produced 110 pieces per cutting edge, with much lower tip and holder mortality.

3 K7H produced 8 to 12 times more pieces at twice the speed

OPERATION: A machine tool manufacturer ran this operation on 280 Brinell Hy-ten B-3X steel, with a .021" feed and ¼" depth of cut.

OLD TOOLING—Results: Brazed tools using a competitive grade of carbide, operating at 210 sfm, cut only 2 to 3 pieces per grind.

WITH K7H—Results: K7H inserts on a Kendex Holder, averaged 25 pieces per cutting edge operating at 500 sfm.

The above results are typical performances of Kennametal Grade K7H on job after job. K7H has phenomenal strength (three times that of nonmetallics—even at high temperatures), top resistance to shock plus unusual resistance to wear and cratering. Try it on your hard-to-machine and high velocity jobs. A Kennametal tool engineer will be glad to assist you. Why not call him or write KENNAMETAL INC., Latrobe, Pa.

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CENTERS, Lathe

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Buck Tool Co., 220 Schippers Lane, Kalamazoo, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., Cleveland, Ohio.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

CHAINS, Power Transmission and Conveyor

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa.

CHISELS AND CHISEL BLANKS

Bethlehem Steel Co., Bethlehem, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.

CHUCKING MACHINES

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Goss & DeLeeuw Mch. Co. (Multiple Spindle), Kensington, Conn.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
National Acme Co. (Single and Multiple Spindle), 170 E. 131st St., Cleveland, Ohio.
Potter and Johnson Co., 1027 Newport Ave., Pawtucket, R. I.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 83, Ohio.

CHUCKS, Air Operated

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Buck Tool Co., 220 Schippers Lane, Kalamazoo, Mich.
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Schraders Son, A., 470 Vanderbilt Avenue, Brooklyn, N. Y.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
Tomkins-Johnson Co., Jackson, Mich.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

CHUCKS, Collet or Split

See Collets

CHUCKS, Diaphragm

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gleason Works, 1000 University Ave., Rochester, N. Y.
Van Norman Co., 2640 Main St., Springfeld 7, Mass.

CHUCKS, Drill

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Jacobs Mfg. Co., West Hartford, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
Supreme Products, Inc., 2222 So. Calumet Ave., Chicago 16, Ill.

CHUCKS, Full Floating

Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Gisholt Mch. Co., Madison 10, Wis.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Gear

Gleason Works, 1000 University Ave., Rochester, N. Y.
Horton Chuck, Windsor Locks, Conn.
Supreme Products, Inc., 2222 So. Calumet Ave., Chicago 16, Ill.

CHUCKS, Lathes, etc.

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Buck Tool Co., 220 Schippers Lane, Kalamazoo, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Horton Chuck, Windsor Locks, Conn.
Jacobs Mfg. Co., West Hartford, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

(Continued on page 280)

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TROUBLE FREE MOTOR CONTROL

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BULLETIN 609 MANUAL ACROSS-THE-LINE STARTERS UP TO 5 HP, 220 V; 7½ HP, 440-550 VOLTS

A Kindt-Collins Master profile grinder equipped with an A-B Bulletin 609 manual starter and an A-B Bulletin 807 drum switch.

Allen-Bradley drum switches come in many styles and ratings. Send for bulletin.

Bulletin 609 arc hood lifted to show the contacts.

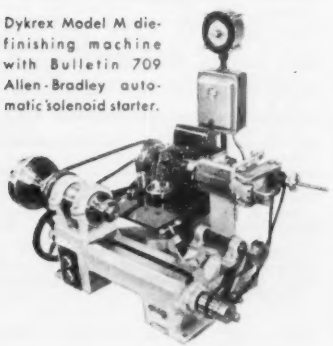
These Bulletin 609 manual starters are popularly used on motorized machines where no safety hazard to workmen is created if the machines should start unexpectedly, after a power interruption.

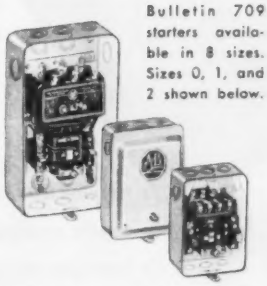
The quick-make, quick-break switch has double break, silver alloy contacts which require no maintenance.

Two thermal breakers give dependable overload protection, no matter how long in service. They are reset by pressing the RESET button.

BULLETIN 709 AUTOMATIC ACROSS-THE-LINE STARTERS UP TO 300 HP, 220 V; 600 HP, 440-550 VOLTS

Dykrex Model M die-finishing machine with Bulletin 709 Allen-Bradley automatic solenoid starter.





Bulletin 709 starters available in 8 sizes. Sizes 0, 1, and 2 shown below.

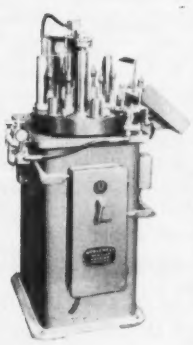
Quality appearance and reputation for reliability make Bulletin 709 starters an asset to any machine.

Bulletin 709 solenoid starters provide the safety feature of no-voltage protection. If the motor is stopped, due to power line interruption, it cannot restart until the operator presses the Start button.

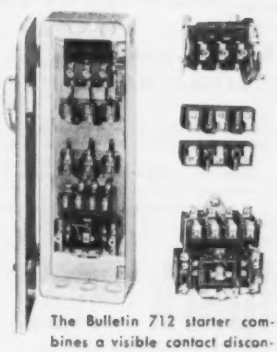
All Bulletin 709 starters have silver alloy, double break contacts that need no filing, cleaning, or dressing. They are good for millions of trouble free operations.

Two overload relays protect the motor against burnouts.

BULLETIN 712-713 COMBINATION AUTOMATIC STARTERS UP TO 100 HP, 220 V; 200 HP, 440-550 VOLTS



Noble & Westbrook Roll-O-Mark marking machine equipped with A-B Bulletin 712 combination starter. Makes a neat & compact installation.



The Bulletin 712 starter combines a visible contact disconnect and a Bulletin 709 starter.

Bulletin 713 combination starters combine, in one enclosure, an I-T-E instantaneous circuit breaker and a Bulletin 709 starter.

Thermal overload relays are standard equipment on all Bulletin 712-713 combination starters.

Bulletin 712-713 starters provide the additional protection that the cabinet cannot be opened unless the disconnect lever is OFF; the starter is then "dead."

Allen-Bradley Co., 1329 S. First St., Milwaukee 4, Wis. • In Canada—Allen-Bradley Canada Ltd., Galt, Ont.

For more information fill in page number on Inquiry Card, on page 241

CHUCKS, Magnetic
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Hanchett Magna-Lock Corp., Big Rapids, Mich.
Walker, O. S., Co., Inc., Worcester, Mass.

CHUCKS, Power Operated
Buck Tool Co., 220 Schippers Lane, Kalamazoo, Mich.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Quick Change and Safety
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Ring Wheel
Gardner Mch. Co., 414 E. Gardner St., Beloit, Wis.

CHUCKS, Tapping
DoAll Co. 254 N. Laurel Ave., Des. Plaines, Ill.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Jacobs Mfg. Co., West Hartford, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CIRCUIT-BREAKERS
General Electric Co., Schenectady 5, N. Y.

1 Unit... 3 Filtration Processes

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• GRAVITY ATTRACTION
• FILTRATION

Delpark UP-FLO MAGNETIC SEPARATOR AND FILTER

...WITH PERMANENT FILTER SCREEN and 3 COMPLETELY AUTOMATIC CLEANING DEVICES

Combines the new Delpark powerful magnetic separator with a permanent filter media bar stock screen. Swarf bearing liquids flow on top of a large flat magnetic field. Magnetic unit incorporates more Alnico #5 magnets, gives twice the width of field, brings all swarf in suspension within the influence of the magnetic field, puts gravity to work in assisting the magnets and prevents washing and turbidity by using low velocity flow. This feature is particularly desirable on high viscosity fluids.

Three cleaning devices, completely automatic, remove the separated residue from the unit. Chain driven flights remove deposits from the magnetic field and the bar stock screen. .004" bar screen is cleaned by an air shaker device to dislodge enmeshed particles. A drag-out unit is built into the clean coolant tank.

Up-Flo Filters are available without magnetics for non-ferrous metal applications.

See your Delpark representative for more complete information or write.

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Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Starrett, The L. S., Co., Athol, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

CLEANERS, Chemical, for Metal
Bullard Co., Bullard-Dunn Process Div., Brewster St., Bridgeport 2, Conn.
Oakite Products, Inc., 19 Rector St., New York, N. Y.

CLUTCHES
Clearing Mch. Corp., Div. U. S. Industries, Inc., 6499 W. 65th St., Chicago, Ill.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Federal Machine & Welder Co., Overland Ave. Warren, Ohio.
Rockford Clutch Div., Borg-Warner Corp., 410 Catherine St., Rockford, Ill.
Twin Disc Clutch Co., 1361 Racine St., Racine, Wis.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

COLLARS, Safety
Standard Pressed Steel Co., Jenkintown, Pa.

COLLETS
Axelson Mfg. Co., 6160 S. Boyle Ave., Los. Angeles 58, Cal.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Tomkins-Johnson Co., Jackson, Mich.
Universal Engrg. Co., Frankenmuth 2, Mich.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

COMPARATORS
See Gages, Comparator

COMPARATORS, Optical
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Eastman Kodak Co., Rochester, N. Y.
Jones & Lamson Mch. Co., Springfield, Vt.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

COMPOUNDS, Cleaning
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Oakite Products, Inc., 19 Rector St., New York.

COMPOUNDS, Cutting, Grinding, Metal Drawing, Etc.
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich. (Broaching & Lopping).

Oakite Products, Inc., 19 Rector St., New York, N. Y.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 Fifth Ave., New York.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.
White & Bagley Co., Worcester, Mass.

COMPOUNDS, Resin and Molding
Bakelite Co., Div. of Union Carbide & Carbon Corp., 30 E. 42nd St., N.Y., N.Y.
General Electric Co., Schenectady 5, N. Y.

COMPRESSORS, Air
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.

CONTOUR FOLLOWER
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Turchan Follower Machine Co., 8259 Livernois and Alaska Aves., Detroit, Mich.

CONTRACT WORK
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Blanchard Mch. Co., 64 State St., Cambridge Mass.
Columbus Die-Tool Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Eisler Engrg. Co., 760 S. 13th, Newark 3, N. J.
Erie Foundry Co., Erie, Pa.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Fellows Gear Shaper Co., Springfield, Vt.
Hartford Special Machry. Co., 287 Homestead Ave., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland, Ohio.
Lees-Bradner Co., Cleveland, Ohio.
Minster Machine Co., Minster, Ohio.
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Rivett, Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Mch. Tool Co., 250 Kishwaukee St., Rockford, Ill.
Sheffield Corp., 721 Springfeld St., Dayton 1, Ohio.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

CONTROLLERS
Allen-Bradley Co., 1326 S. 2nd St., Milwaukee.
Clark Controller Co., Cleveland, Ohio.
General Electric Co., Schenectady 5, N. Y.

CONVEYORS FOR DUST, CHIPS, ETC.
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.

COOLANT SEPARATORS
See Separators, Oil or Coolant

COOLANT SYSTEMS
Gray-Mills Co., 1948-52 Ridge Ave., Evanston, Ill.

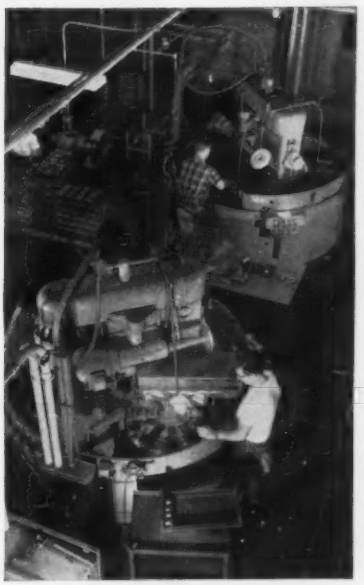
COPPER
American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

COUNTERBORES
Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Ex-Cello-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.

(*Continued on page 283*)

BESLY-BOWEN GRINDERS

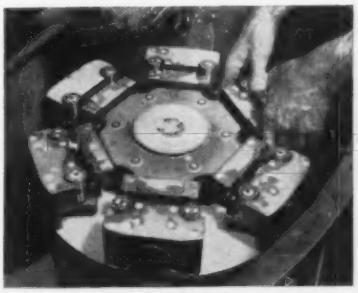
Keep Costs Down and Tolerances Tight at G.E.'s Appliance Park, Louisville



These Besly-Bowen 711 Radial Head Grinders, equipped with 18" abrasive wheels, finish grind steel compressor cylinder brackets. Picture shows how grinding takes place at one table while the other table is unloaded (grinder at right).

At General Electric's amazing Appliance Park — where all major household appliance manufacturing is centralized—Besly-Bowen Grinders are doing a remarkable job.

The machines pictured at the right — Besly-Bowen 707's and 711's — turn out a variety of parts, including refrigerator compressor pistons and steel compressor cylinder brackets also used in refrigerators. Simple enough to do, with the right equipment, and Besly grinders have come up with the answers. Result: tolerances held to microscopic dimensions, virtually automatic continuous operation with loading and unloading at one station while grinding takes place at the other. All of this adds up to precision parts, ground at high speed and low cost.



Positioning compressor pistons for finish grinding in a Besly-Bowen 707 Grinder, while grinding takes place at the machine's second table. 400 pieces per hour are ground to .001" for size and .0005" for flatness.

On another Besly Double Horizontal Spindle Disc Grinder valve discs used in refrigerators are ground 950 pieces per hour with tolerances held to plus .00015" and *minus zero* — all in a single pass that takes less than 4 seconds!

Besly can do as much for you. Write for details or ask to have a Besly Sales Engineer sit in with you.

BESLY

BESLY-WELLES
CORPORATION

Est. as C. H. Besly & Co. 1875
112 Dearborn Avenue • South Beloit, Illinois

production begins with

Columbus Die-Tool

Get production off to a profitable start! Use Columbus Die-Tool engineered tools. Jigs, Fixtures, and Special Machinery individually designed and built to produce your product alone . . . at a rate to match your production schedule. That's production economy! That's the wisdom of CDT special machinery! That's how Columbus Die-Tool can put your production on a profitable basis. Columbus Die-Tool are specialists in building special tools, jigs, fixtures and machinery . . . have been for over 50 years. Talk over your special problems with us. Absolutely no obligation. Write today.

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AND MACHINE COMPANY
P. O. BOX 750 • COLUMBUS, OHIO
ESTABLISHED 1906

Manufacturers of
JIGS • FIXTURES • BUILDING MACHINE TOOLS COMPLETE
SPECIAL TOOLS • UNITS FOR MACHINE TOOLS

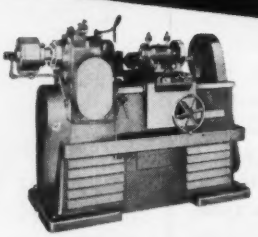
GETTING BETTER THREADS

. . . in Less Time
. . . at Lower Costs
is Coulter Magic!

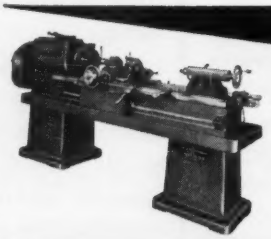
Coulter Threading Machines

Day-in and day-out production figures show that COULTERS produce threaded parts FASTER . . . AUTOMATICALLY . . . on non-ferrous and heat treated metals . . . long and short runs . . . all sizes diameters and lengths . . . high speed production milling. COULTERS start earning their way the moment you make the first threads. Perform with accuracy and ease of handling normally found only on much heavier, more expensive machines.

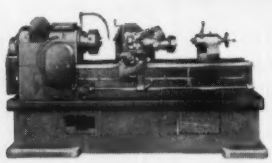
THREE COULTERS *for your threading needs!* Each machine has its own design features; engineered for low and high speeds, quick change-overs, individual versatility.



"H1" Completely automatic for precision internal and external right and left hand threads, 4 to 50 per inch. Internal: 5/8" to 8". External: 3/16" to 7".



TYPE "A" MODEL "L1" This is the most versatile lathe built for fast production of Square, Standard and 29 degree threads, internal and external. Has over 25 alternatives for setting up the threading tools. Capacities: up to 195" length of thread.



"THREADMASTER" Produces, automatically, long and short traversing, elevating cross feed lead screws with over 55 changes of the work spindle. Mills threads from 1/3 to 20 per inch and leads from .05 to 5.5".

See for yourself how these rugged COULTER THREADING MACHINES can save you money! Ask your COULTER Dealer about them today, or write direct. Literature and engineering service available, of course.

The James Coulter Machine Co.
Machine Tool Builders Since 1896
643 Railroad Ave. Bridgeport 5, Conn.

Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 52nd St., New York.
Kennametal, Inc., Latrobe, Pa.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Starrett, The L. S., Co., Athol, Mass.
Threadwell Tap & Die Co., Greenfield, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

COUNTERSHAFTS
Standard Pressed Steel Co., Jenkintown, Pa.

COUNTERSINKS
Besly-Welles Corp., 112 Dearborn Ave., Beliot, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Ex-Cell-O Corp., 120 Oakman Blvd., Detroit 32, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

COUNTERS, Revolution
Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett, The L. S., Co., Athol, Mass.

COUNTING DEVICES
Starrett, The L. S., Co., Athol Mass.

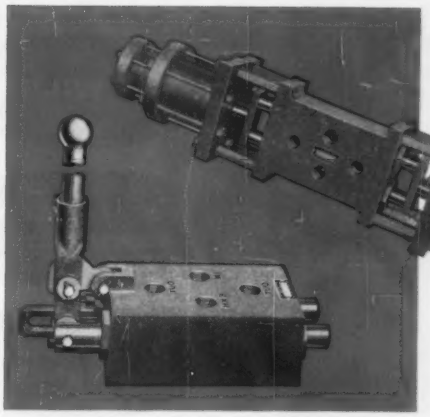
COUPLINGS, Flexible
Boston Gear Works 3200 Main St., North Quincy, Mass.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.

COUPLINGS, Shaft
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Cone-Drive Gear Div., Michigan Tool Co. 7171 E. McNichols Rd., Detroit 12, Mich.
Standard Pressed Steel Co., Jenkintown, Pa.

CRANES, Electric Traveling
Cleveland Crane & Engrg Co., Wickliffe, Ohio.

CUTTER GRINDERS
See Grinding Machines, for Sharpening Cutters, Reamers, Hobs, Etc.
(Continued on page 284)

Quick-As-Wink® HYDRAULIC VALVES



Double Pilot Cylinder Operated 3-position 4-way Hydraulic Valve

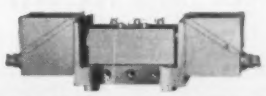
(At left) Lever Operated 3-position 4-way Hydraulic Valve

Hand and Pilot-operated Types for water or hydraulic oils to 5000 psi.

• These valves give users maximum efficiency, economy and dependability. Housings are milled from steel blocks or bronze forgings. The hollow, radially ported, stainless steel plungers are hard chrome plated and polished. Renewable metal valving rings assure long life of the packers which are expanded by internal pressure . . . the higher the pressure the tighter the seal. No metal to metal seating. The valves are fully balanced in any position. Inspection — and servicing if necessary — can be done easily *in the field,* avoiding the delays of returning valves to the factory for servicing, or the need to carry large inventories of standby valves — or even parts. Complete dimensions, capacities and other data sent promptly. Write for Bulletin No. 531,— Today!

Ask us also about . . .

CAM OPERATED SINGLE PLUNGER VALVE 3/8" to 3/4" sizes. Operated by rotating cam or land on reciprocating device.



DOUBLE SOLENOID "O-TYPE" VALVE for pressures up to 125 psi. Widely used as pilot valves and for operating air cylinders.

Quick-As-Wink® AIR AND HYDRAULIC Control Valves

Hand, Foot, Cam, Pilot, Diaphragm and Solenoid Operated

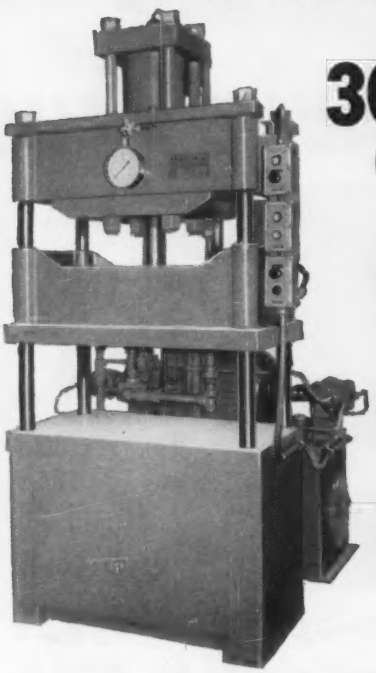
Mfd. by C. B. HUNT & SON, INC., 1941 East Pershing St., Salem, Ohio

NOW AVAILABLE

TO

300 TONS

CAPACITY



K. R. WILSON

FOUR COLUMN DOWN ACTING

HYDRAULIC PRESSES

Model No. 755-2436

OFFERS CUSTOM-BUILT ACCURACY

– YET YOU PAY ONLY THE LOW COST OF A STANDARD LINE PRESS

The original purchase price is just the first of a long series of savings you'll enjoy with a K. R. Wilson Four Column, Guided Platen Hydraulic Press, from 25 to 300 tons capacity. Substantial savings also result from higher quality work with far fewer rejects . . . less wear of dies and fixtures . . . and the elimination of costly interruptions in production schedules due to press difficulties.

In versatility as well as economy, the Wilson Four Column Press stands second to none. With its many new design and operating features, it can be readily adapted to efficient, low-cost metal forming and drawing, plastics and rubber molding, laminating, die cutting, assembling, die try-out, pressing, or to any other application requiring precise control of an accurately guided platen. Right down the line, you save time and money when you work with a Wilson!

CHECK THESE FEATURES AND YOU'LL CHOOSE WILSON

1. **DAYLIGHT ADJUSTMENT** — Easy — Just change a spacer. **RETURN STROKE ADJUSTMENT** — Positive.
2. **VARIABLE PRESSURES AND SPEEDS** to meet every requirement.
3. **FULL TONNAGE** available at any point of platen travel.
4. **PLATENS ARE ALIGN-BORED** to optically controlled tolerances.
5. **SOUNDLY ENGINEERED** and precision built for greater economy.
6. **FAST TRAVERSE WITH SLOW PRESSING** as well as fast return.
7. **MAXIMUM STROKE LIMIT CONTROL** for safety and to prevent damage.
8. **COMPACT, SELF-CONTAINED PUMPING UNITS** for trouble-free service.
9. **CONTROLS** for every operating requirement; manual; semi-automatic; or full automatic.
10. **EXTRA-LONG PLATEN GUIDES** plus polished and ground columns.

Get full details and complete specifications. Write for Bulletin No. 95.

HYDRAULICS DIVISION

K. R. WILSON, Inc.

Offices & Factories – 212 Main St., Arcade, N.Y., U.S.A.

CUTTERS, Gear

Brown & Sharpe Mfg. Co., Providence, R. I.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 6, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich. (Shaving).
National Twist Drill & Tl. Co., Rochester, Mich.
Waltham Mch. Works, Newton St., Waltham, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTERS, Keyseater

Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
du Mont Corp., Greefield, Mass.
Ex-Cello-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Threadwell Tap & Die Co., Greenfield, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTERS, Milling

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Barber-Colman Co., Rock St., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kennametal, Inc., Latrobe, Pa.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Motch & Merryweather Mchry Co., Penton Bldg., Cleveland, Ohio.
National Twist Drill & Tl. Co., Rochester, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chi-Mich.
Tomkins-Johnson Co., Jackson, Mich.
Wesson Co. 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTERS, Rotary

See Files & Burrs Rotary

CUTTING COMPOUNDS

See Compounds, Cutting, Grinding, Etc.

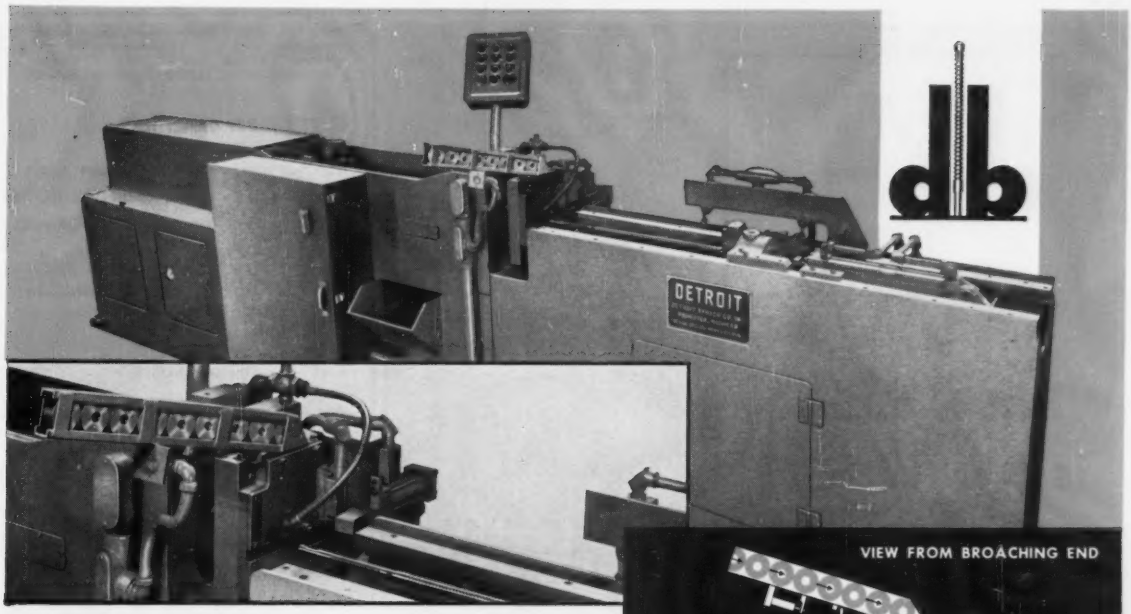
CUTTING AND GRINDING FLUIDS

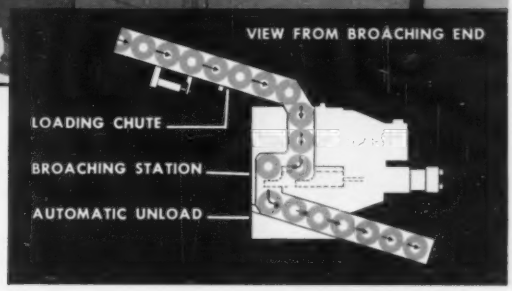
Cincinnati Milling Products Div., Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cimcool Div., Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Cities Service Oil Co., 70 Pine St., New York, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Shell Oil Co., 50 W 50th St., New York, N. Y.
Sinclair Refining Co., 600 Fifth Ave., New York.
Standard Oil Co., (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

CUTTING-OFF MACHINES

Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cone Automatic Mch. Co., Windsor, Vt. (Lathe Type).
Consolidated Mch. Tool Co., Rochester, N. Y.

(Continued on page 286)





Detroit Broach Horizontal Machine Broaches I.D. and Nineteen Splines

- ***Sizes I.D. and holds it concentric with Spline P.D.***
- ***Completely automatic 8-second cycle***

This 3-ton, 36-inch stroke Detroit Horizontal Broaching Machine is inexpensive, fast, and offers automatic operation, tool handling and work ejection. While manual chute loading is illustrated, optional automatic loading is easily accomplished.

During its 8-second automatic cycle the machine accurately sizes the I.D. and broaches 19 precision internal splines, keeping them 100% concentric with the I.D. Thus, subsequent operations are performed more easily and economically because of simplified work location and improved accuracy.

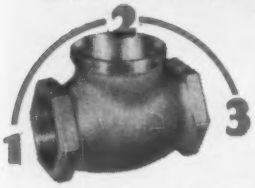
This simplicity with high production is typical of Detroit Broach & Machine Company engineering. Detroit builds every size and type of broaching machine, and will automate and tool them to fit your needs. Discuss *your* production problem with a Detroit field engineer, or send us details . . . today.

THE CYCLE

1. Part drops through chute into "LOAD" position
2. Loader pushes part into broaching position
3. Loading signals automatic tool handling mechanism to move broach in to engage broach puller
4. Broach is pulled through work to end of pre-set stroke
5. Loader returns, broached part drops into unloading chute, next part drops into "LOAD" position
6. Returned loader signals machine to return broach to tool handling mechanism.
7. Machine slide stops, tool handling mechanism returns broach to "START" position
8. Cycle repeats . . . EVERY 8 SECONDS!

DETROIT BROACH
& MACHINE COMPANY
DEPARTMENT 8-8
ROCHESTER, MICHIGAN

What is done is DONE... on the GOSS & DeLEEUW



AUTOMATIC CHUCKING MACHINE

There are no half-finished pieces lying around at the end of the day when you put your work on this outstanding machine.

The "1-2-3" feature—available only on the Goss & De Leeuw Automatic Chucker —provides the means of finish machining three ends of a part without changing set-up.

Note some of the typical parts machined. Ask for illustrated literature giving further details and send samples of your work for a cost estimate on handling it on the Goss & De Leeuw.

GOSS & DeLEEUW QUALITY PRODUCT-QUANTITY PRODUCTION

GOSS & DeLEEUW MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Landis Machine Co., Waynesboro, Pa., (Pipe).
Modern Machine Tool Co., 601 S. Water St., Jackson, Mich. (Lathe Type for Tubing).

CUTTING-OFF MACHINES, Abrasive Wheel

Campbell Machine Div., American Chain & Cable, Bridgeport, Conn.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Hamilton Div., The Lodge & Shipley Co., Hamilton 1, Ohio.

CUTTING-OFF MACHINES, Cold Saw

See Sawing Machines, Circular

CUTTING-OFF MACHINES, Metal Band Saws

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Johnson Mfg. Co., Albion, Mich.

CUTTING-OFF TOOLS

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York N. Y.
Kennametal, Inc., Latrobe, Pa.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo.

CUTTING-OFF WHEELS, Abrasive

Norton Co., 1 New Bond St., Worcester, Mass.
Simonds Abrasive Co., Tacony & Farley Sts., Philadelphia 37, Pa.

CYLINDER BORING MACHINES

Baker Bros., Inc., Sta. F, Box 101, Toledo 10, Ohio.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Ingersoll Milling Mch. Co., 2424 Douglas St., Rockford, Ill.
Michigan Drill Head Co., Detroit 34, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

CYLINDERS, Air

Hannifin Corp., 501 Wolf Rd., Des Plaines, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Tomkins-Johnson Co., Jackson, Mich.

CYLINDERS, Hydraulic

Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
Logansport Machine Co. Inc., 810 Center Ave., Logansport, Ind.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kiswaukee St., Rockford, Ill.
Shenango-Penn Mold Co., Dover, Ohio.
Tomkins-Johnson Co., Jackson, Mich.

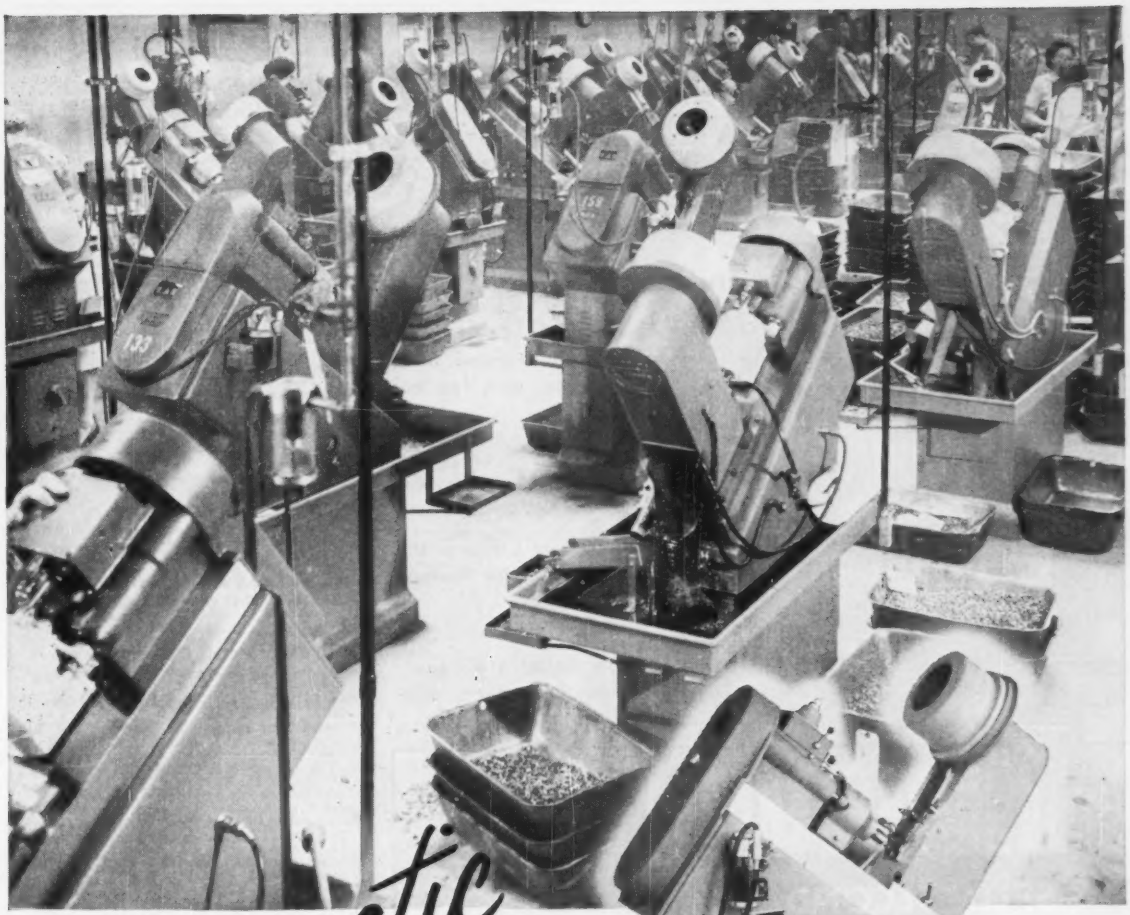
CYLINDERS, Pneumatic

Shenango-Penn Mold Co., Dover, Ohio.

DEALERS, Machinery

Falk Machinery Co., 18 Ward St., Rochester, N. Y.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
Ryerson Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

(*Continued on page 288*)



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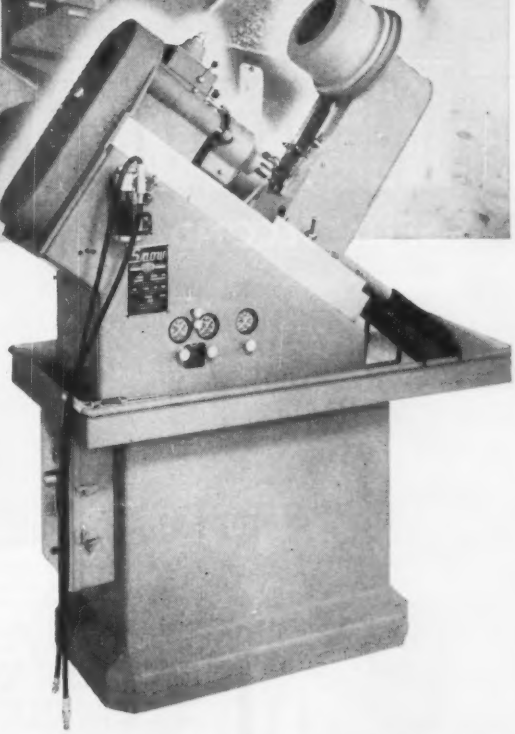

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Bath, Cyril Co., Aurora & Solon Road, Solon, Ohio
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Hartford Specialty Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co. 14230 Birwood Ave., Detroit 4, Mich.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

DIE-CASTING
See Castings, Die

DIE-CASTING MACHINES
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Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
Lake Erie Engineering Corp., Kenmore Station, Buffalo, N. Y.

DIE CUSHIONS
Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Clearing Mch. Corp., Div. U. S. Industries, Inc. 6499 W. 65th St. Chicago, Ill.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.

DIE INSERTS, Carbide
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Kennamental Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.

DIEMAKERS' SUPPLIES
Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

DIEMAKING MACHINES
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Cincinnati Milling Mach. Co., Oakley, Cincinnati 9, Ohio.
Kearney & Trecker Corp., Milwaukee, Wis.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.

DIE SETS, Standard
Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 225 N. 18th St., Ampere, N. J.
Wales-Strippet Corp., North Tonawanda, N. Y.

DIE-SINKING MACHINES
American Crucible Products Co., 1395 Oberlin Ave., Lorain, Ohio
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Gorton, George, Machine Co., 1110 W. 13th St., Racine, Wis.
Pratt & Whitney Co., Inc., West Hartford, Conn.

DIE-SINKING PRESSES
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Kearney & Trecker Corp., Milwaukee, Wis.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

DIE STOCKS
See Stocks, Die

DIES, Lettering and Embossing
Acromark Co., 9-11 Morrell St., Elizabeth, N. J.

DIES, Sheet Metal, Etc.
Bath, Cyril Co., Aurora & Solon Road, Solon, Ohio
Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Columbus Die-Tool & Mach Co., 955 Cleveland Ave., Columbus, Ohio.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Mch. Co., Bridgeton, N. J.
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Niagara Mch. & Tool Wks., 683 Northland Ave., Buffalo, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.
Wales-Strippet Corp., North Tonawanda, N. Y.
Waltham Mch. Wks., Newton St., Waltham, Mass.

DIES, Threading
Eastern Mch. Screw Corp., New Haven, Conn.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Threadwell Tap & Die Co., Greenfield, Mass.

DIES, Threading, Opening
Eastern Mch. Screw Corp., New Haven, Conn.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Geometric Tool Co., Westville Station, New Haven 45, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

DIES, Thread Rolling
Pratt & Whitney Co., Inc., West Hartford, Conn.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

(*Continued on page 290*)

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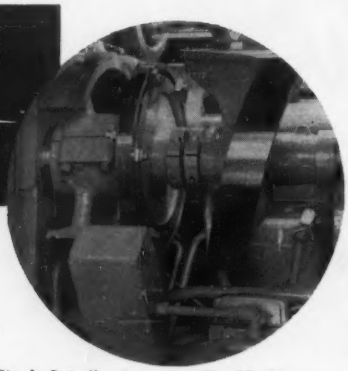
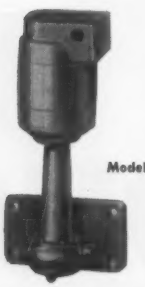
COOLANT FLOW
with Ruthman GUSHER Coolant Pumps



Illustrated is a Cleveland Dialamatic Single Spindle Automatic Bar Machine equipped with a Gusher Coolant Pump.



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Hotform

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DISCS, Abrasives

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Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.
Thor Power Tool Co., Aurora, Illinois
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See Indexing and Spacing Equipment

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Producto Machine Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

DRESSERS, Grinding Wheel

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Colonial Broach & Machine Co., P. O. Box 37, Harper St., Detroit 13, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Norton Co., 1 New Bond St., Worcester, Mass.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

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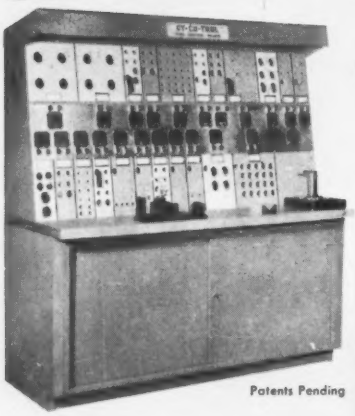

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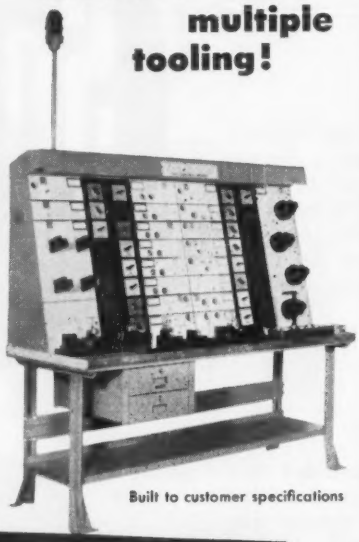

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Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

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Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit, Mich.
Govro-Nelson Co., 1933 Antoinette St., Detroit 8, Mich.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6302 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Snyder Tool & Engrg. Co., 3400 Lafayette, Detroit 7, Mich.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
United States Drill Head Co., 616 Burns, Cincinnati, Ohio.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

DRILL HEADS, Unit Type

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Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
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Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morris Machine Tool Co., Inc., 946-H Harriet St., Cincinnati 3, Ohio.
Rehnberg-Jacobson Mfg. Co., 2135 Kiswaukee St., Rockford, Ill.
Snow Manufacturing Co., Bellwood, Illinois

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Cleveland Twist Drill Co., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

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Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

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Avey Drilling Mach., Co., 26 Third St., Covington, Ky.
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Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bodine Corp., Mt. Grove St., Bridegport, Conn.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Kingsbury Mch. Tool Corp. Keene, N. H.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morris Machine Tool Co., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snow Manufacturing Co., Bellwood, Illinois
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Townsend, H. P., Mfg. Co., Elmwood, Conn.
Wales-Strippet Corp., North Tonawanda, N. Y.
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Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Edlund Machinery Co., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

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Foote-Burt Co., 1300 St. Clair Ave., Cleveland.

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Michigan Drill Head Co., Detroit 34, Mich.
National Automatic Tool Co., Inc., S. 7th and N. St., Richmond, Ind.
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Wales-Strippet Corp., North Tonawanda, N. Y.

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Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
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Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Edlund Machinery Co., Cortland, N. Y.
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Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Michigan Drill Head Co., Detroit 34, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
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Barnes, W. F. & John Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
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Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
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(*Continued on page 292*)

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Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
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Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Michigan Drill Head Co., Detroit 34, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

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Avey Drilling Mach. Co., 26 E. Third St., Covington, Ky.
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Cross Co., 3250 Bellevue, Detroit 7, Mich.
Michigan Drill Head Co., Detroit 34, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. St., Richmond, Ind.

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Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Edlund Machinery Co., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Greenlee Bros. & Co., 12th and Columbia Ave., Rockford, Ill.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kingsbury Mch. Tool Corp., Keene, N. H.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14320 Birwood Ave., Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snow Manufacturing Co., Bellwood, Illinois
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit, Mich.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Townsend, H. P., Mfg. Co., Elmwood, Conn.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

DRILLING MACHINES, Radial

American Tool Works Co., Pearl and Eggleston Ave., Cincinnati, Ohio.
Carlton Mch. Tool Co., 3000 Spring Grove Ave., Cincinnati 25, Ohio.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.

DRILLING MACHINES, Rail

See Drilling Machines, Gang

DRILLING MACHINES, Sensitive

Atlas Press Co., Kalamazoo, Mich.
Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Edlund Machinery Co., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, 8, Ohio.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Snow Manufacturing Co., Bellwood, Illinois
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Townsend, H. P., Mfg. Co., Elmwood, Conn.
Wales-Strippet Corp., North Tonawanda, N. Y.

DRILLING MACHINES, Upright

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Atlas Press Co., Kalamazoo, Mich.
Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Edlund Machinery Co., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hartford Special Mchry Co., 287 Homestead Ave., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Moline Tool Co., 102 20th St., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. St., Richmond, Ind.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Snow Manufacturing Co., Bellwood, Illinois
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Wales-Strippet Corp., North Tonawanda, N. Y.

DRILLING MACHINES, Wall, Radial

Cleveland Punch & Shear Works, 3817 St. Clair Ave., N.E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.

(Continued on page 294)

Another of the Reasons Behind Brad Foote Quality—

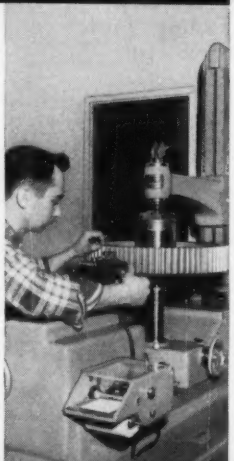
TOOTH SPACING

• 99% of gear drawings do not specify tooth spacing. For most applications, industry generally believes that competent gear manufacturers, working by standard AGMA practices, will produce gears within the limitations required for easy assembly and good load transmission.

• Occasionally, however, on very precise jobs you may find it necessary to specify extreme accuracy of tooth spacing and nonadjacent tooth spacing. Applications such as radar mounts, timing mechanisms, indexing mechanisms—all may require closer tooth spacing tolerances than are obtainable with average equipment in the hands of regular gear manufacturers.

• BRAD FOOTE welcomes precision jobs like these. We can add to highly specialized equipment specific experience in meeting this, as well as many other demanding requirements for special gear production.

• Prove to yourselves the savings that BRAD FOOTE quality can mean. Let us quote on the gear requirements for your next program.



BRAD FOOTE MAKES ALL TYPES OF GEARS—
IN A COMPLETE RANGE OF STYLES AND SIZES

BRAD FOOTE GEAR WORKS, INC.

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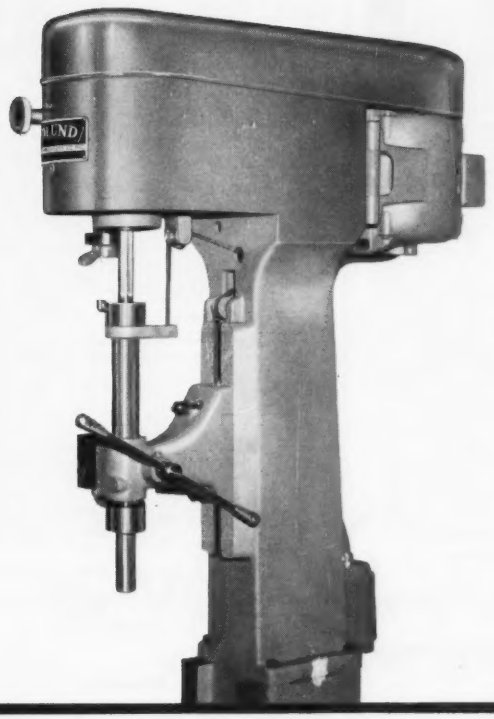
Bishop 2-1070 • Olympic 2-7700 • TWX CIC-2856-U

subsidiaries | AMERICAN GEAR & MFG. CO. Lemont, Illinois Phone Lemont 920 • PITTSBURGH GEAR COMPANY Phone SPalding 1-4600 Pittsburgh 23, Penn.

EDLUND MODEL 2FV

NEW! CONTINUOUS PRODUCTION DRIVE

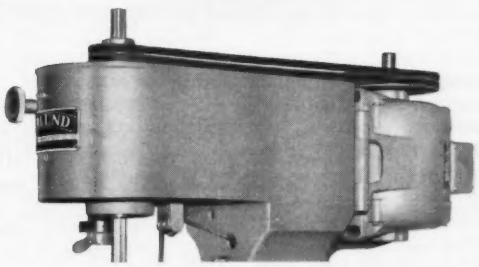


- **Lower Original Cost**
- **Economical Maintenance**
- **Positive Control over Production Speeds**

Now, a new type drive is offered for the EDLUND Model 2F—America's most popular drilling machine.

Designed for those companies having long production runs at either one or several pre-selected speeds, this new drive offers lower initial cost.

This machine employs the same rugged construction and modern features available on the Model 2F machine, with the exception of the infinitely variable speed drive. You can easily convert to other speeds or to the infinitely variable speed drive whenever your production requirements change. Write for Bulletin 140V for complete data and specifications.

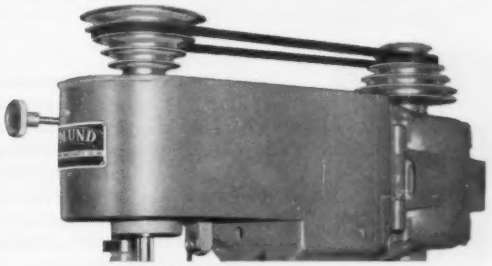


2FV-1 Single Step Sheave

For plants requiring one continuous speed for drilling and/or tapping operation.

Available, in any specified single speed. (Back Gear gives second speed with 4:1 speed reduction)

(View With Guard Removed)



2FV-5 Five Step Sheave

For production set-ups that require several predetermined speeds.

Choice of motor plus 5-step sheave and Back Gear provide ranges between 60 and 4800 RPM.

(View With Guard Removed)

Contact the EDLUND Representative in your area for:

DRILLING AND TAPPING MACHINES

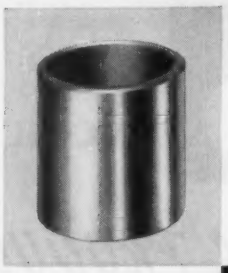
Capacities — through 1½"

- Hand Feed Units
- Cam Feed Units
- Motor Spindle
- Cone Pulley Drives
- Variable Speed Drives

EDLUND MACHINERY COMPANY

Cortland, New York

Division of Harsco Corporation



THESE NEW

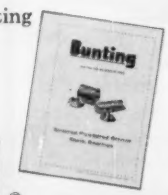
Bunting®

BEARINGS MAY SOLVE YOUR COST PROBLEM

A more complete, advantageous bearing service than has heretofore existed came into being when Bunting added self-lubricating sintered powdered Bronze Bearings to the long established line of Bunting Cast Bronze Bearings and Bars. These new Bunting sintered bronze plain, flange and thrust bearings and bars are made to Bunting's traditional high standards of quality and precision. They embody knowledge gained in long and varied experience in manufacturing Bronze Bearings for all applications in the mechanical industry. They fully meet modern requirements.

Bunting Sintered Bronze products will be manufactured and distributed in the same responsible manner that has established Bunting leadership in the field of Cast Bronze Bearings. Use them with confidence.

BOTH Bunting Cast Bronze and Bunting oil filled, self-lubricating sintered powdered Bronze Bearings and Bars are available to you through your nearest Bunting Distributor. He has in stock all sizes for your immediate needs. Ask him or write for complete lists and dimensional data on Bunting Cast Bronze and Bunting Sintered Bronze Bearings.



Bunting®

BUSHINGS, BEARINGS, BARS AND SPECIAL PARTS OF CAST BRONZE AND POWDERED METAL

The Bunting Brass and Bronze Company, Toledo 1, Ohio
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DRILLS, Center

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILL, Core

Ace Drill Corp., Adrian, Michigan.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Deep Hole

Ace Drill Corp., Adrian, Michigan.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
Star Cutter Co., Farmington, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Portable Electric

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati Ohio.
Thor Power Tool Co., Aurora, Illinois.

DRILLS, Portable Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York 9, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Thor Power Tool Co., Aurora, Illinois

DRILLS, Rachet

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Subland

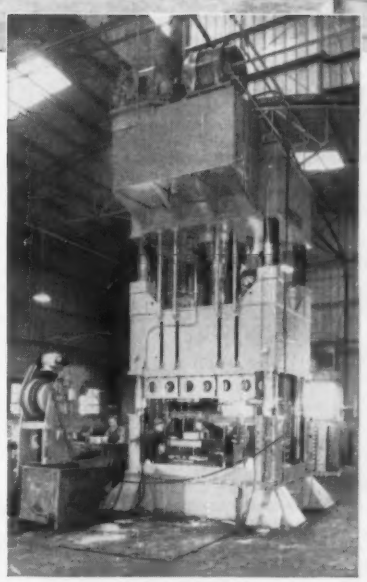
Ace Drill Corp., Odrian, Michigan.
pelier, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Twist

Ace Drill Corp., Adrian, Michigan.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.

(Continued on page 296)

This —Verson— line-up cuts costs on double sump sinks



• The press line illustrated above, part of the final operations in forming double sump sink units before porcelain enamelling, includes Verson eccentric, hydraulic and crank presses. Previous operations on the sinks include deep drawing the sumps to a depth of 7⅜" from 14 gauge Armco deep drawing stock on a 1000 ton Verson hydraulic press and piercing and embossing the center drain hole in the sinks on a Verson O.B.I. Both of these presses are shown at the right.

This is more than just a line-up of Verson presses . . . it's a production process engineered by Verson to cut costs as an integrated part of the complete manufacturing program. Verson has the experience and facilities to meet the most exacting press requirements . . . and the "know how" to blend these presses into an efficient and practical production process.

Put Verson facilities to work for you. Send an outline of your production requirements.

A Verson Press for every job from 60 tons up.

TRADE Verson MARK

ORIGINATORS AND PIONEERS OF ALLSTEEL STAMPING PRESS CONSTRUCTION

VERSON ALLSTEEL PRESS CO.

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MECHANICAL AND HYDRAULIC PRESSES AND PRESS BRAKES • TRANSMAT PRESSES • TOOLING • DIE CUSHIONS • VERSON-WHEELON HYDRAULIC PRESSES

For more information fill in page number on Inquiry Card, on page 241

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfeld, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Spiral Step Tool Co., Chicago 25, Ill.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Wire

Ace Drill Corp., Adrian, Michigan.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DUPLICATORS

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.

Gorton, George Mch. Co., 1110 W. 13th St., Racine, Wis.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

DUST COLLECTORS

Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Pangborn Corp., Hagerstown, Md.

DUST CONTROL SYSTEMS

Pangborn Corp., Hagerstown, Md.

ELECTRICAL EQUIPMENT

General Electric Co., Schenectady 5, N. Y.

EMERY WHEEL DRESSERS

See Dressers, Grinding Wheel

EMERY WHEELS

See Grinding Wheels

END MILLS

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.

ENGRAVING MACHINES

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, Geo., Mach., 1110 W. 13th St., Racine, Wis.

EXTRACTORS, Screw

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

FACING MACHINES

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Michigan Drill Head Co., Detroit 34, Mich.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.

FANS, Exhaust, Electric Ventilating

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
General Electric Co., Schenectady 5, N. Y.

FEEDS FOR PRESSES, Automatic

Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Federal Press Co., Elkhart, Ind.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

FELT, For All Applications

American Felt Co., Glenville, Conn.

FILES, Hack

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Heller Tool Co., Newcomerstown, Ohio
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FILES, Hand

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Heller Tool Co., Newcomerstown, Ohio.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FILES, Machine

DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Heller Tool Co., Newcomerstown, Ohio
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

FILES AND BURS, Rotary

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Heller Tool Co., Newcomerstown, Ohio
Pratt & Whitney Co., Inc., West Hartford, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FILING MACHINES, Dies, Etc.

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Oliver Instrment Co., 1410 E. Maumee St., Adrian, Mich.

FILTERS, Coolant and Oil

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Commercial Filters Corp., Lebanon, Indiana
Cuno Engineering Corp., Meriden, Conn.
Industrial Filtration Co. (Delpark Corp.), 15 Industrial Ave., Lebanon, Ind.
Marvel Engineering Co., 7227 N. Hamlin Ave., Chicago 45, Ill.

FILTERS, Fire-resistant Fluids

Marvel Engineering Co., 7227 N. Hamlin Ave., Chicago 45, Ill.

FILTERS, Hydraulic Oils

Marvel Engineering Co., 7227 N. Hamlin Ave., Chicago 45, Ill.

FILTERS, Water

Marvel Engineering Co., 7227 N. Hamlin Ave., Chicago 45, Ill.

(Continued on page 298)

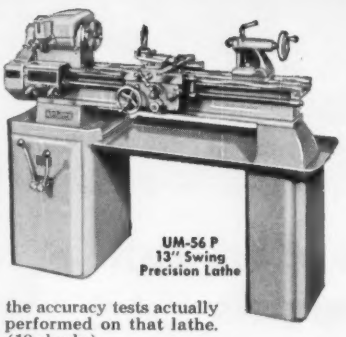
SHELDON Precision LATHES

for the size Lathes You Need Most

Sheldon lathes are built in the sizes you need most, for toolroom and production jobs. They are available with swings of 10", 11" and 13". . . in varying bed lengths with 18" to 48" center distances . . . and . . . in your choice of pedestal, cabinet or bench mountings.

Powerful, all-V-belt, drive units—either the standard 8-speed (or 16-speed) E-drive; or the production favorite, a rapid, lever-shift U-drive. Where higher spindle speeds are desired, the standard E-drive can be built to provide speeds up to 2,000 r.p.m.

All Sheldon Lathes have handscraped, built-in precision. Each lathe is guaranteed to meet or surpass the American Standards for Toolroom Accuracy. With every Sheldon Lathe goes a copy of the accuracy tests actually performed on that lathe. (19 checks).



UM-56 P
13" Swing
Precision Lathe

Important optional features include: hardened bed ways, L00 Long Taper Key Drive spindles, 4" D1 Camlock spindles, bed turrets, taper attachments and a complete line of toolroom and production accessories.

The new Sheldon-built Sebastian Geared Head Lathes have greatly increased work capacity and many advanced features. These include a wide, heavy, hardened and ground bed . . . easy shifting spindle speed dial . . . 60-pitch gear box . . . independent drop lever apron clutches . . . cam-action tailstock clamp . . . and, automatic lubrication in the headstock and apron with "1-shot" lubrication of carriage.

Sheldon-Built
Sebastian 13" and 15" Geared Head
Precision Lathes

Send in coupon or write for catalogs and names of nearest Sheldon and Sebastian Distributors where you can see these new lathes in operation.

SHELDON MACHINE CO., INC.
4246 North Knox Avenue, Chicago 41, Illinois

Gentlemen: Please send new catalogs describing:

☐ Sheldon ☐ 10", ☐ 11' ☐ 13" Lathes
☐ Sebastian 13" and 15' Geared Head Lathes
☐ Horizontal Milling Machine ☐ Name of Local Dealer
☐ Sheldon 12" Shaper ☐ Have representative Call;

Name ..... Title .....
Company Name .....
Street Address ..... ☐ Company ☐ Home
City ..... State .....

SHELDON
Horizontal Milling Machine

SHELDON
12" Shaper

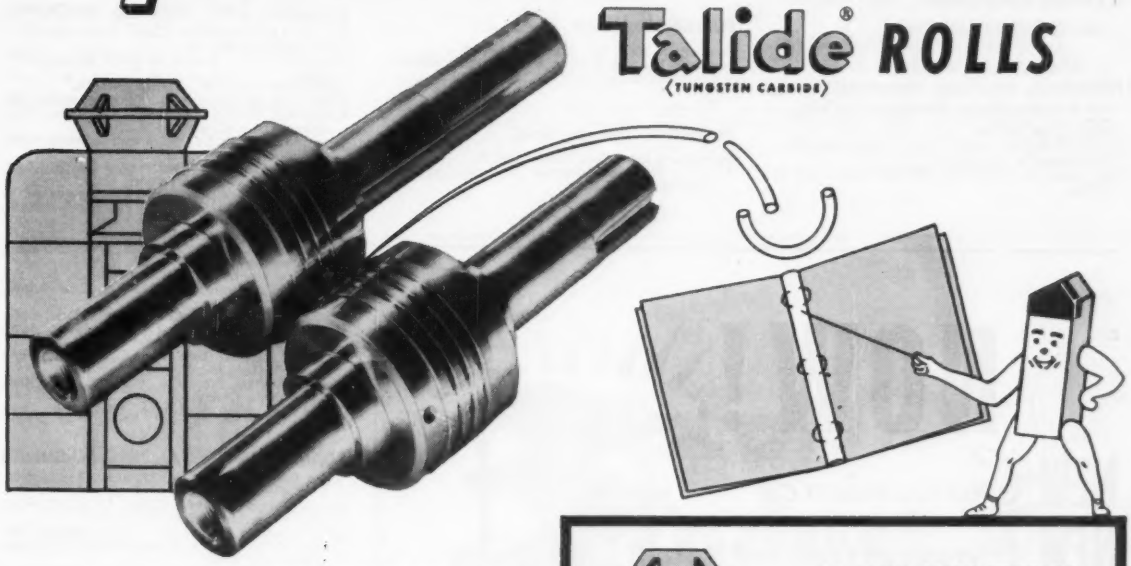
SHELDON MACHINE CO., Inc.

Builders of Sheldon Lathes, Milling Machines, Shapers and Sebastian Lathes.

4246 North Knox Ave • Chicago 41, Ill.

7 years' continuous service with Talide® ROLLS

(TUNGSTEN CARBIDE)



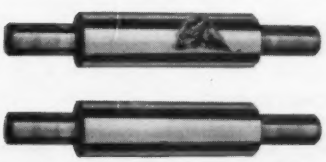
● A large Eastern Producer of oval-shape wire for loose-leaf notebook rings was experiencing excessive wear and pick-up. The high scrap rate was making the item unprofitable. Metal Carbides service engineers were called in to determine if Talide rolls could correct the trouble. Hi-carbon wire was being reduced on a 2-hi cold rolling mill to an oval shape .100" thick x .156" wide. Considerable stress and pressure was required to deform the wire to proper shape.

Our engineers designed a roll incorporating a carbide sleeve having 3 grooves ground in periphery and mounted to a special alloy steel arbor. The initial pair of rolls was installed in 1948 and has been in continuous service ever since. Due to their extreme hardness it has not been necessary to remove them from the mill during this 7-year period—not even for a regrind! Size and shape of wire has been perfectly maintained. Customer has since installed similar rolls on all their mills.

SUPERSET GRINDING WHEEL

The Superset diamond grinding wheel was specially developed for grinding carbide rolls to highest possible surface finish and luster. Made of 4-8 micron size diamond dust, it imparts a surface finish far superior to any other commercial wheel. Available in sizes up to 25" diameter.

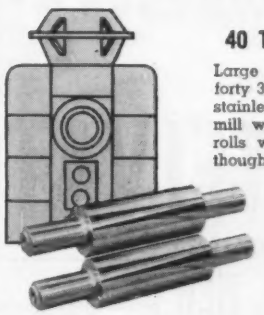
EXCLUSIVE REPAIR SERVICE



Broken or damaged carbide rolls can be re-worked to first class condition with all defects eliminated at one-half original cost. Only Metal Carbides offers this service—because of its exclusive hot press method.

Metal Carbides Corporation,
Youngstown 12, Ohio.

Send for new 84-page catalog 56-G

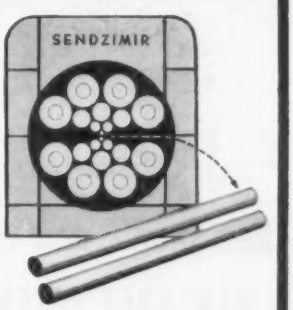


40 TIMES MORE TONNAGE

Large Steel Producer cold rolls forty 3,000 lb. coils (60 tons) of 18-8 stainless steel, series 300, on 4-hi mill with one pair of solid Talide rolls with no surface wear, even though strip work hardens to 50 Rockwell "C" in one pass. Flatter, smoother strip produced—even when rolling intermittent widths. 40 pairs of steel rolls were required previously to produce same tonnage.

ROLL LIFE INCREASED 278 to 1!

All users of Sendzimir rolling mills have adopted Talide work rolls because operating results have been phenomenal, far surpassing all expectations. Tremendous production runs are commonplace with mill after mill reporting increased tonnage runs between roll changes of 278-1, 179-1, 82-1, etc.



Talide Rolls are made in lengths up to 100", diameters up to 25", and up to 5000 pounds by weight.

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TALIDE®
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HOT PRESSED AND SINTERED CARBIDES • VACUUM METALS
HEAVY METAL • CERMETS • HIGH TEMPERATURE ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

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Lowe Bros. Co., Dayton, Ohio.

FLEXIBLE COUPLINGS
See Couplings, Flexible

FORGINGS, Machines (Upsetting)
Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.

FORGINGS, Drop
Bethlehem Steel Co., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

FORGINGS, Hollow Bored
Bethlehem Steel Co., Bethlehem, Pa.
National Forge & Ordnance Co., Irvine, Warren County, Pa.

FORGINGS, Iron and Steel
Bethlehem Steel Co., Bethlehem, Pa.
National Forge & Ordnance Co., Irvine, Warren County, Pa.

FORGINGS, Upset
Bethlehem Steel Co., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

FORMING AND BENDING MACHINES
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bath, Cyril Co., Aurora & Solon Road, Solon, Ohio
Bethlehem Steel Co., Bethlehem, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Milling Machine Co., Process Machinery Div., Cincinnati 9, Ohio
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N.E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Erie Foundry Co., Erie, Pa.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
Lake Erie Eng. Corp., 470 Woodward Ave., Buffalo, N. Y.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Yoder Co., 5500 Walworth, Cleveland, Ohio.

FORMING AND STAMPING MACHINES
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Federal Press Co., Elkhart, Ind.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
Lake Erie Eng. Corp., 470 Woodward Ave., Buffalo, N. Y.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

FORMING TOOLS or Tool Blanks
Brown & Sharpe Mfg. Co., Providence, R. I.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametel, Inc., Latrobe, Pa.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FRAMES, Machinery Welded
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

FURNACES, Heat-Treating
Ajax Electric Company, Philadelphia, Pa.
General Electric Co., Schenectady 5, N. Y.
Holcroft and Co., 6545 Epworth Blvd., Detroit 10, Mich.

FURNITURE, Shop
Standard Pressed Steel Co., Jenkintown, Pa.

GAGE BLOCKS
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

GAGES, Air
Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

5603

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NEW Convenience
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NEW Designs

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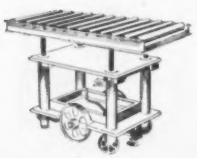

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NEW provision for raising and lowering overhanging loads!

NEW convenience in maneuvering! Six wheel models roll easier . . . turn shorter.

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More stamina, more versatile performance than ever before

NEW FREE LITERATURE illustrates and describes all! Write for Bulletin P-5603. Address, The Hamilton Tool Company, 834 South Ninth Street, Hamilton, Ohio.

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GAGES, Comparator

Ames, B. C., Co., Waltham 54, Mass.
Comtor Co., 47 Farwell St., Waltham 54, Mass.
Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.

GAGES, Depth

Ames, B. C., Co. (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1927, Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

GAGES, Dial

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

GAGES, Electric

Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

GAGES, Height

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Starrett, The L. S., Co., Athol, Mass.

GAGES, Plug, Ring and Snap

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Pa.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Winter Bros. Co., Rochester, Mich.

GAGES, Surface

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Starrett, The L. S., Co., Athol, Mass.

GAGES, Taper

Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Starrett, The L. S., Co., Athol, Mass.

GAGES, Thread

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R.I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Winter Bros. Co., Rochester, Mich.

GASKETS

Crane Packing Co., 1800 Cuyler Ave., Chicago.
Garlock Packing Co., Palmyra, N. Y.

GEAR BLANKS, Non-Metallic

General Electric Co., Schenectady 5, N. Y.

GEAR BURNISHING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.

(Continued on page 300)

5408

precision product?

EXACT HOLES ARE IMPERATIVE!

HAMILTON VARIMATIC®
Super Sensitive
Variable Speed
Small Hole
Precision
Drilling Machine

Are you fighting the never-ending battle of trying to produce exact holes on a drilling machine which, itself, is not built to precision tolerances? You are under no necessity to do so. For the difference in price between the cheapest bench type, small hole drilling machine and the Hamilton Varimatic is reckoned in pennies per day. And the Hamilton Varimatic (holes from .004" to 5/16" in all drillable materials) is *super sensitive*. Provides speeds, *infinitely variable*, between 840 R.P.M. and 9300 R.P.M. Is built to *precision tolerances*, and with the stamina to *retain* precision.

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IT'S A **Hamilton Tool**
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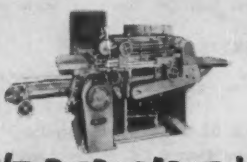

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—says PACKAGE MACHINERY COMPANY Springfield, Mass.

"We have found LUBRIPLATE Lubricants to be very effective and use them extensively in our machines. To assure the proper use of LUBRIPLATE Lubricants for re-lubrication, we place tags on our machines before shipment. Thus the purchasers of those machines know the LUBRIPLATE Product we recommend for each application and where to obtain it."

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Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

GEAR CHAMFERING, ROUNDING AND BURRING MACHINES

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

GEAR CHECKING INSTRUMENTS AND EQUIPMENT

Brown & Sharpe Mfg. Co., Providence, R. I.
Eastman Kodak Co., Rochester, N. Y.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.

GEAR CUTTING MACHINES, Bevel Gears (Generators)

Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES Bevel Gears, Spiral

Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES, Spur and Bevel Gears (Rotary Cutter)

Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Waltham Machine Works, Newton St., Waltham, Mass.

GEAR CUTTING MACHINES, Spur and Helical Gears (Hobbing)

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Lees-Bradner Co., Cleveland, Ohio.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

GEAR CUTTING MACHINES, Spur and Helical Gears (Shaper or Planer Type)

Farrell-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

GEAR CUTTING MACHINES, Worm and Worm Wheels

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield Vt. (Straight and Hourglass Types).
Lees-Bradner Co., Cleveland, Ohio.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR FINISHING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEAR GRINDING MACHINES

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Lees-Bradner Co., Cleveland, Ohio.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Van Norman Co., Springfield, Mass.

GEAR HARDENING MACHINES

Gleason Works, 1000 University Ave., Rochester 3, N. Y.

GEAR LAPPING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEAR MOTORS

See Speed Reducers

GEAR SHAVING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEAR TESTING MACHINERY

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Eastman Kodak Co., Rochester, N. Y.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Lees-Bradner Co., Cleveland, Ohio.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEARS, Cut

Automotive Gear Works, Inc., Richmond, Ind.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Brad Foote Gear Wks., 1309 So. Cicero Ave., Chicago 50, Ill.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio.
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.
Cone-Drive Gears Div., Michigan Tool Co., 7200 E. McNichols Rd., Detroit, Mich.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Fairfield Mfg. Co., 2309 S. Earl Ave., Lafayette, Ind.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Gear Specialties Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Greaves Machine Tool Co., 2009 Eastern Avenue, Cincinnati, Ohio.
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio.
Illinois Gear & Mch. Co., 2120 No. Natchez Ave., Chicago 35, Ill.
Lees-Bradner Co., Cleveland, Ohio.

Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
New Jersey Gear Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

GEARS, Rawhide and Non-Metallic

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Gear Specialties Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Greaves Machine Tool Co., 2009 Eastern Avenue, Cincinnati, Ohio.
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.

GEARS, Stamped

Winzeler Mfg. & Tool Co., 1712 W. Arcade Pl., Chicago 12, Ill.

GENERATORS, Electric

General Electric Co., Schenectady 5, N. Y.
Lincoln Electric Co. (Arc), 22801 St. Clair Ave., Cleveland, Ohio.
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio.

GRADUATING MACHINES

Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Machine Tool Co., 2009 Eastern Avenue, Cincinnati, Ohio.

GREASE

Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Lubriplate Div., Fiske Bros. Refining Co., 129 Lockwood St., Newark 5, N. J.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 5th Ave., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia.
Texas Co., 135 E. 42nd St., New York, N. Y.

GRINDERS, Carbide Tool

See Grinding Machines, Carbide Tool

GRINDERS, Die and Mold

Consolidated Mch. Tool Corp., Rochester, N. Y.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

GRINDERS, Oilstone, for Woodworking Tools

Mummert-Dixon Co., Hanover, Pa.

GRINDERS, Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Madison-Kipp Corp., Madison, Wis.
Thor Power Tool Co., Aurora, Illinois.

GRINDERS, Portable Electric and Toolpost

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Thor Power Tool Co., Aurora, Illinois.

GRINDING FIXTURES

Geometric Tool Co. (Die Chaser), Westville Station, New Haven 15, Conn.

GRINDING MACHINES, Abrasive Belt

Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Mch. Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

GRINDING MACHINES, Bench

Atlas Press Co., Kalamazoo, Mich.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Sterling Grinding Wheel Co., Tiffin, Ohio
U. S. Burke Machine Tool Div., Brotherton Rd. 17, Cincinnati 27, Ohio.

GRINDING MACHINES, Broach

Colonial Broach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Lapointe Mch. Tool Co., 34 Tower St., Hudson, Mass.

GRINDING MACHINES, Camshaft

Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

(Continued on page 302)

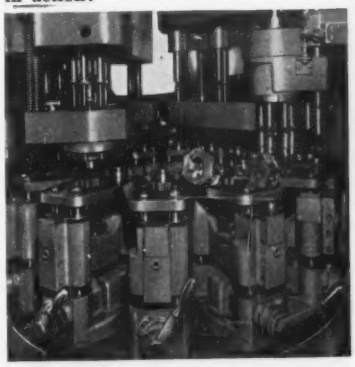
MILLHOLLAND

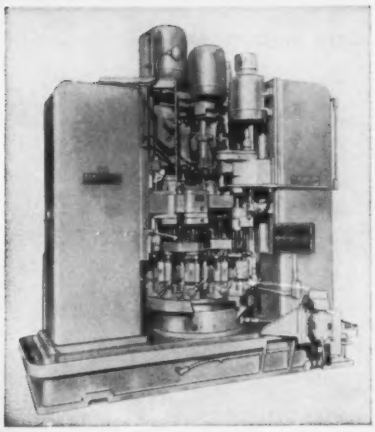
12-Station Vertical Indexing Machine

34 Spindles!

93 Pieces per Hour!

Here is Millholland versatility in action!





Unique Holding Fixture

With a 31-second cycle time, this machine produces 93 pieces per hour at 80% efficiency! This chip cutting efficiency is made possible by the distinctive design of the plate type cam used in Millholland Automatic Units, plus the action of the pneumatic counterbalance.

Two No. 5 Units are mounted vertically, the first with 22 spindles, the second with 5; a No. 2 unit is mounted horizontally on a rapid travel slide, and an Automatic Lead Screw Tapper with reversing motor drives a 6-spindle tapping head. All machine elements are electrically synchronized, with push-button control for "cycle start," automatic single cycle, set-up and emergency stop. Chip disposal is simplified with wiper blades rotating within a ring on the index table to bring chips to a removable pan.

Part requirements dictated location using self-centering horizontal vees with up-acting clamps, actuated by a single handle operating through a small arc. Fixtures also contain register pins for all bushing plates. The 12 fixtures are mounted on an independently powered automatic index table with self-contained lubrication pump.

A complex production problem, solved efficiently with Millholland equipment and Millholland know-how.

Write for Bulletin M-8 giving further details.

W. K. MILLHOLLAND MACHINERY CO.
6402 Westfield Blvd. Indianapolis 20, Indiana

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American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

GRINDING MACHINES, Centerless

Cincinnati Grinders Incorporated, Cincinnati 9, Ohio
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Landis Tool Co., Waynesboro, Pa.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.
Van Norman Co., Springfield, Mass.

GRINDING MACHINES, Chucking

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bryant Chucking Grinder Co., 257 Clinton St., Springfield, Vt.
Bullard Co., Brewster St., Bridgeport, Conn.
Landis Tool Co., Waynesboro, Pa.

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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Frauenthal Div., Kaydon Eng. Corp., Muskegon, Mich.
Landis Tool Co., Inc., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Rivett Lathe & Grinder Inc., Brighton, Boston 35, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Van Norman Co., 2640 Main St., Springfield 7, Mass.

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Eastern Mch. Screw Corp., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Disc

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

GRINDING MACHINES, Drill

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Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

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Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Hamilton Div. of the Lodge & Shipley Co., Hamilton 1, Ohio.
Mattison Machine Works, Rockford, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.

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GRINDING MACHINES, Gap

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Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Gear Tooth

See Gear Grinding Machines

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Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Landis Tool Co., Waynesboro, Pa.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
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Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio.

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Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
South Bend Lathe Works Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Walker, O. S., Co., Inc., Worcester, Mass.
Waltham Machine Works, Newton St., Waltham, Mass.

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American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Bryant Chucking Grinder Co., 257 Clinton St., Springfield, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Frauenthal Div., Kaydon Eng. Corp., Muskegon, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Rivett Lathe & Grinder Inc., Brighton, Boston 35, Mass.
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Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

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Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio

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Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Sheffield Corp., 721 Springfield St. Dayton 1, Ohio.

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Van Norman Co., Springfield, Mass.

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Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

GRINDING MACHINES, Radius, Link

Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

GRINDING MACHINES, Roll

Cincinnati Grinders Incorporated, Cincinnati 9, Ohio
Farrel-Birmingham Co., 25 Main St., Ansonia, Conn.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Spline Shaft

Van Norman Co., Springfield, Mass.

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American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass. (Rotary)
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Blanchard Machine Co., 64 State St., Cambridge, Mass.
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Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Frauenthal Div., Kaydon Eng. Corp., Muskegon, Mich.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
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Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
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Mattison Machine Works, Rockford, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
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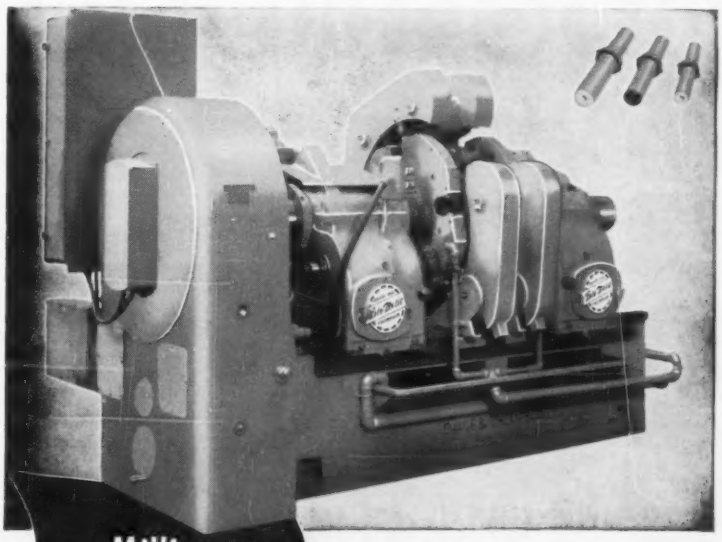
GRINDING MACHINES, Tap

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.

(Continued on page 304)



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Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

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Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.

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Cincinnati Milling Products Div., Cincinnati Milling Machine Co., Cincinnati, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gardner Machine Co. (Surface Grinder), 414 E. Gardner St., Beloit, Wis.
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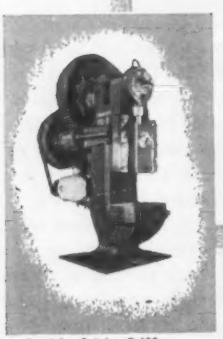

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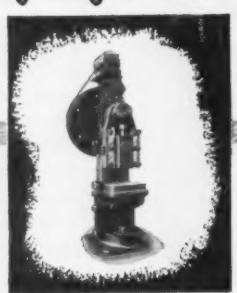

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See Gear Cutting Machines, Spur and Helical Gears (Hobbing), and Gear Cutting Machines, Worm and Worm Wheels.

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Moline Tool Co., 102 20th St., Moline, Ill.
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Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
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Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.
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Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
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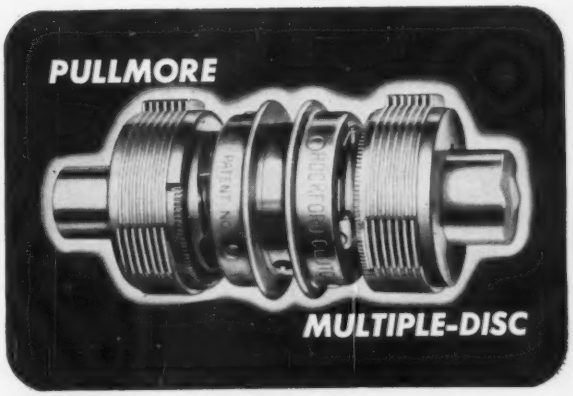
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

(Continued on page 306)

ROCKFORD



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KEYSEATERS

Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Consolidated Mch. Tool Co., Rochester, N. Y.
Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Mitts & Merrill, 68 Holden St., Saginaw, Mich.

KNURL HOLDERS

Brown & Sharpe Mfg. Co., Providence, R. I.

KNURLING TOOLS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

LAPPING MACHINES

Barnes Drill Co. (Straight Line or Rotating), 814 Chestnut St., Rockford, Ill.
Cincinnati Grinders Incorporated (Centerless), Cincinnati 9, Ohio
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill. (Lapmaster Div.)
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.

LAPPING PLATES, Hand

Crane Packing Co., 1800 Cuyler Ave., Chicago.

LATHE AND GRINDING DOGS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

LATHE ATTACHMENTS

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio.
Atlas Press Co., Kalamazoo, Mich.
Axelson Mfg. Co., P.O. Box 15335, Vernon Sta., Los Angeles 58, Cal.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Jones & Lamson Mch., 160 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sidney Machine Tool Co., Sidney, Ohio.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio.
Sundstrand Mch. Tool Co., 2431 11th St., Rockford, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

LATHES, Automatic

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Goss & DeLeeuw Mch. Co., Kensington, Conn.
Hydra-Feed Machine Tool Corp., 730 W. Eight Mile Rd., Ferndale 20, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfeld, Vt.
LeBlond, R. K. Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Seneca Falls Mch. Co., Senaca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Wickes Brothers, 512 No. Water St., Saginaw, Mich.

LATHES, Axle

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K. Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Bench

Atlas Press Co., Kalamazoo, Mich.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Levin, Louis & Son, Los Angeles 21, Calif.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

LATHES, Boring

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25 Ohio.
Sidney Machine Tool Co., Sidney, Ohio.
Wickes Brothers, 512 No. Water St., Saginaw, Mich.

LATHES, Crankshaft

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Wickes Brothers, 512 No. Water St., Saginaw, Mich.

LATHES, Double-End

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.

(Continued on page 308)

Fully automatic BURR-MASTERS
for deburring internal & external gears and splines
ABOVE: MODEL BMI-15 FOR INTERNAL GEARS
BELOW: MODEL BME-24 FOR EXTERNAL GEARS
• Entire tooth form including root deburred and chamfered at 5 teeth per second—automatic load, deburr and unload
• Production not limited to a single gear—changes in automation tooling permit wide work range
• Long-life form tools assure maximum production between grinds, rapid changeover
• Two-station BME-24 deburrs both sides of external gears from ⅛" to 6½" P.D. Single-station BMI-15 handles internal gears from 2" to 20" P.D.
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Industrial Engineering Co.
14230 BIRWOOD AVE.
DETROIT 38, MICHIGAN

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Wickes Brothers, 512 No. Water St., Saginaw, Mich.

LATHES, Duplicating

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Hydra-Feed Machine Tool Corp., 730 W. Eight Mile Rd., Ferndale 20, Mich.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
Sidney Machine Tool Co., Sidney, Ohio.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

LATHES, Engine and Toolroom

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio.
Atlas Press Co., Kalamazoo, Mich.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Barber-Colman Co. (Hendey Mch. Div.) Rockford, Ill.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Greaves Machine Tool Co., 2009 Eastern Avenue, Cincinnati, Ohio.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
Morey Machinery Co., Inc., 383 Layfette St., New York 3, N. Y.
Nebel Machine Tool Co., 3401 Central Parkway, Cincinnati 25, Ohio
Pratt & Whitney Co., Inc., West Hartford, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Sidney Machine Tool Co., Sidney, Ohio.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio.
Wickes Brothers, 512 No. Water St., Saginaw, Mich.

LATHES, Gap

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Nebel Machine Tool Co., 3401 Central Parkway, Cincinnati 25, Ohio
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sidney Machine Tool Co., Sidney, Ohio.
Springfield Mch. Tool Co., Springfield, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

LATHES, Gun

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Springfield Machine Tool Co., Springfield, Ohio.
Wickes Brothers, 512 No. Water St., Saginaw, Mich.

LATHES, Hollow Spindle

Axelson Mfg. Co., P.O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

LATHES, Manufacturing Type

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Hydra-Feed Machine Tool Corp., 730 W. Eight Mile Rd., Ferndale 20, Mich.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.

LATHES, Spinning

Bliss, E. W., Co., 1375 Raff Rd., S. W. Canton, Ohio.
Ferracute Machine Co., Bridgeton, N. J.

LATHES, Toolroom

See Lathes, Engine and Toolroom

LATHES, Turret

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Bardons & Oliver Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Brothers, Inc. (Bench or Cabinet Mounting), 1418 College Ave., Elmira, N. Y.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Morey Machinery Co., Inc., 383 Layfette St., New York 3, N. Y.
Potter & Johnston Co. (Automatic), 1027 Newport Ave., Pawtucket, R. I.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

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For more than fifty years automotive production has relied on Walker holding devices. One of the most popular chucks in the Detroit area is Walker 617 CG (concentric gap) type, a rectangular chuck that combines longitudinal and transverse gaps. Produced in sizes to meet all holding requirements.

Walker engineers can solve any holding problem.

What is yours?

O. S. WALKER CO. Inc.

WORCESTER 6, MASSACHUSETTS

Original Designers and Builders of Magnetic Chucks

Springfield Mch. Tool Co., Springfield, Ohio.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

LATHES, Vertical Turret

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baird Machine Co. 1700 Stratford Ave., Stratford, Conn.
Bullard Co., Brewster St., Bridgeport 2, Conn.

LAYOUT FLUID

Dykem Co., 2303 P. North 11th St., St. Louis 6, Mo.

LEVELS

Bullard Co., Brewster St., Bridgeport 2, Conn.
Starrett, The L. S., Co., Athol, Mass.

LIGHTS, Indicator

Dialight Corporation, 60 Stewart Ave., Brooklyn 37, N. Y.

LOCATORS, for Jig Borers

Arter Grinding Machine Co., 15 Sagamore Rd., Worcester 5, Mass.

LUBRICANTS, Including Extreme Pressure (EP) Machinery Lubricants

Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Lubriplate Div., Fiske Bros. Refining Co., 120 Lockwood St., Newark 5, N. J.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 5th Ave., New York, N. Y.
Socony Mobil Co., Inc., 26 Broadway, New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.
White & Bagley Co., Worcester, Mass.

LUBRICATING SYSTEMS

Farval Corp., 3249 E. 80th St., Cleveland, Ohio.
Madison-Kipp Corp., Madison, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.

MACHINISTS' SMALL TOOLS

See Calipers, Hammers, Wrenches, Drills, Taps, etc.

MAGNESIUM

Dow Chemical Co., Midland, Mich.

MAGNETIC BASES FOR INDICATORS

du Mont Corp., Greenfield, Mass.

MANDRELS

See Arbors and Mandrels

MARKING MACHINES AND DEVICES

Acromark Co., 9-11 Morrell St., Elizabeth 4, N. J.
Colonial Broach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.

MASKS, PAINTING

Conforming Matrix Corp., 342 Toledo Factories Bldg., Toledo 2, Ohio.

MATERIALS HANDLING TRUCKS

Automatic Transportation Co., 133 W. 87th St., Chicago 20, Ill.

MEASURING MACHINES AND INSTRUMENTS, Precision

Crane Packing Co., 1800 Cuyler Ave., Chicago.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Starrett, The L. S. Co., Athol, Mass.

METAL, Bearings

See Bearings, Bronze, Babbitt, Etc., and Bushings, Brass, Bronze, Etc.

METAL DISINTEGRATOR

Elox Corp., Royal Oak, Mich.

METERS

See Recording Instruments

MICROMETERS

Ames, B. C., Co. (Dial) Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.

MICROSCOPES, Toolmakers

Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

MILLING ATTACHMENTS

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kempsmith Machine Co., Milwaukee, Wis.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING AND CENTERING MACHINES

Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Jones & Lamson Mch. Co. (Automatic), 160 Clinton St., Springfield, Vt.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

(Continued on page 310)

BIG—FAST AND ECONOMICAL

model J
Heavy Duty Band Saw (Wet or Dry)

HERE'S the finest metal cutting band saw available anywhere today . . . and, at the lowest price. The big, rugged Johnson Model J easily and accurately handles 10" rounds, 18" flats—affords a quick, simple set up plus entirely automatic operation. Beautifully designed and engineered, yet a brute for work, the versatile Model J is immediately available in the standard wet or dry models to suit your needs.

The big, dependable Model J will cut *anything* in your stock pile—faster and more accurately. See for yourself, how much time, labor and production dollars you can save with a Johnson saw.

SPECIFICATIONS

Capacity—10" rounds, 18" flats
Motor—½ H. P. Ball Bearing any voltage available, single or polyphase (¾ H. P. on wet machine)
Wheel Diameters—16"
Floor Space—66" x 31"
Bed—11" wide, 44" long, 6" deep, 24" high
Overall Height (Closed)—39"
Blade Length—11' 5" x ¾" x 032" All Standard blades of these specifications can be used.
Weight—Approximately 750 lbs. Crated 800 lbs. Boxed for export 875 lbs.
Speeds—35, 90, 130, 190 feet per minute
Casters—Optional at slight extra cost

OTHER MODELS AVAILABLE

Other nationally popular members of the Johnson line of metal cutting Band Saws include the 5" x 10" capacity Model "B" (wet or dry), the unique versatile mobile Model "M" and the Johnson Adjustable Stock Stand.

Johnson
MANUFACTURING CORPORATION
MAIN PLANT: 1016 BARNES STREET • ALBION, MICHIGAN

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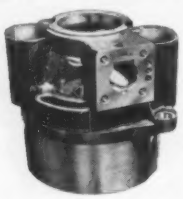
75 N. Broadway
Des Plaines, Illinois

Western Distributor
Hastings Distributors
1605 Solano Avenue
Berkeley, California

Why TECUMSEH Compressor Crankcases Are MICROHONED

"On Tecumseh compressors, we Microhone the piston bores. ***This gives us a running seal between pistons and bores which prevents gas leakage and eliminates the need for piston rings!*** Believe me, it takes a real combination of accuracy and functional surface finish to get results like that . . . and only Microhoning has given us that combination!"

(Tecumseh Products Company, Tecumseh, Michigan, is the world's largest producer of refrigeration compressors. Precision engineered and processed these units are hermetically sealed before leaving the factory.)



"Here's our twin cylinder crankcase. The two piston bores in each case are opposite one another in the vertical plane, but they lie in two different horizontal planes. We simultaneously Microhone both bores in each crankcase, using a horizontal type machine with two opposing spindles."

"Although all of our crankcases are similar in design, the bores vary in diameter—1.312", 1.375", 1.500" and 1.625". Two fixtures on a two-position rotary indexing table let us Microhone one crankcase while another is being loaded. To run different bore diameters we just change the tools and gage rings. Switchover time is about five minutes."

OTHER JOB DATA:

MATERIAL	Cast iron
PRECEDING OPERATION	Diamond finish-bore
MICROHONING OPERATIONS	One
STOCK REMOVAL	.0007" to .001"
FINISH	10 Microinches
TOLERANCES	
Diametric	.0003"
Roundness	.00015"
Straightness (Taper)	.00015"
HONING CYCLE	18 seconds, including fixture indexing time

Let a Micromatic Field Engineer show you how Microhoning will give you better functional finishes, closer tolerances and higher production.

☐ *Please have a Micromatic Field Engineer contact us.*

☐ *Please send literature and case histories on Microhoning.*

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COMPANY_____

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MICROMATIC HONE CORP.

8100 SCHOOLCRAFT AVENUE • DETROIT 38, MICHIGAN

MILLING MACHINES, Automatic

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Springfield, Vt.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Jones & Lamson Mch. Co., 160 Clinton St.,
Kearney & Trecker Corp., Milwaukee, Wis.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

MILLING MACHINES, Bench

Atlas Press Co., Kalamazoo, Mich.
Hardinge Bros., Inc., (Bench or Pedestal Type), 1418 College Ave., Elmira, N. Y.
U. S. Burke Machine Tool Div., Brotherton Rd., Cincinnati 27, Ohio.

MILLING MACHINES, Circular, Continuous

Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Espen-Lucas Mch. Works, Front St., and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Duplex

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Mch. Works, Front St., and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney &Trecker Corp., Milwaukee, Wis.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Townsend, H. P., Mfg. Co., Elmwood, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

MILLING MACHINES, Hand

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
U. S. Burke Machine Tool Div., Brotherton Rd., Cincinnati 27, Ohio.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Horizontal, Plain And Universal

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Machine Tool Co., 2009 Eastern Avenue, Cincinnati, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kempsmith Machine Co., Milwaukee, Wis.
Sheldon Machine Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Lincoln Type

Brown & Sharpe Mfg. Co., Providence, R. I.
Sundstrand Mch., Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINE, Planer Type

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.

Espen-Lucas Mch. Works, Front St., and Girard Ave., Philadelphia, Pa.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave., and Penn. R. R., Evanston, Cincinnati, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.

MILLING MACHINES, Profile

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Ram Type Universal

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Turret Type

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Bridgeport Machine, Inc., Linley Ave., Bridgeport, Conn.

MILLING MACHINES, Vertical

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Ekstrom, Carlson & Co., 1437 Railroad Ave., Rockford, Ill.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Burke Machine Tool Div., Cincinnati 27, Ohio.

MODEL AND EXPERIMENTAL WORK

See Special Machinery and Tools

MOLD AND DIE COPYING MACHINES

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Pratt & Whitney Co., Inc., West Hartford, Conn.

MOLDING MACHINES, Plastic

Erie Foundry Co., Erie, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

MOLYBDENUM

Climax Molybdenum Co., New York, N. Y.

MOTORS, Electric

General Electric Co., Schenectady, N. Y.
Howell Electric Motros Co., Howell, Mich.
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio.

MOTORS, Hydraulic

Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MULTIPLE-SLIDE FORMING MACHINES

U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

NAMEPLATES

Acromark Co., 9-11 Morrell St., Elizabeth, N. J.

NIBBLING MACHINES

Wales-Strippet Corp., North Tonawanda, N. Y.

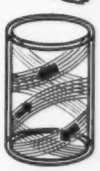
(Continued on page 312)

How MICROHONING Makes a Gas-Tight Running Seal Without Piston Rings

A leak-free, running seal between bores and pistons—without the use of rings—is possible only when the processing method generates diametric and geometric accuracy and the required functional surface finish. These characteristics are simultaneously obtained by the Microhoning process. Here's how:

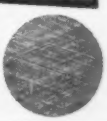
1 The sticks of abrasives in the tool form an abrasive "cylinder" and are fed out radially with equal pressure in all directions. High spots and tight areas in the bore are abraded first.

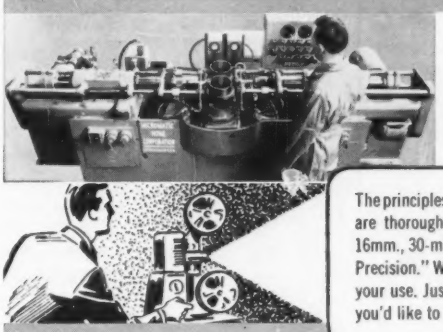
2 The long abrasive sticks cut only on the crests of wavy or snaky surfaces until the bore has the same diameter throughout its full length.



3 The combination of tool motion (rotation and reciprocation) and feed pressure fractures the abrasive grits that have become dull, and new sharp edges are formed; the clean constant cutting action of every stroke on the full bore length consistently generates the desired surface finish.

One of the exclusive advantages of Microhoning is its ability to produce whatever functional surface characteristics are required for maximum product performance. Microhoning's cross-hatch pattern, with its myriad of minute intersecting "valleys," furnishes an excellent surface for retention of lubrication.





"Here's one of two Micromatic Model 523-2 machines used on the compressor crankcase job. Tecumseh uses a total of 18 Microhoning machines on other vital processing operations."

The principles and applications of Microhoning are thoroughly explained in an informative 16mm., 30-minute sound movie, "Progress in Precision." We'll be glad to reserve a print for your use. Just tell us on the coupon the date you'd like to see it.

☐ Please send me "Progress in Precision" in time for showing on _____ (date)

☐ Please send literature on Microhoning. I am interested in the following application: _____

NAME _____

TITLE _____

COMPANY _____

CITY _____ ZONE _____ STATE _____

MICROMATIC HONE CORP.

8100 SCHOOLCRAFT AVENUE · DETROIT 38, MICHIGAN

Finding the
ROTTEN APPLE *in the* **BARREL**

William B Dunn

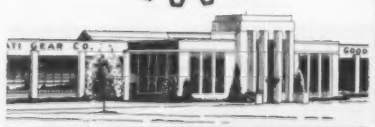
CHIEF INSPECTOR, THE CINCINNATI GEAR CO.

Several years ago we ran an ad entitled "Ears for Gears" that produced a lot of comment. The unusual title was explained in the copy, in which we told how we can individually *sound check* gears for minimum noise level. This checking is done on ultra-modern testing equipment, under specified load and R.P.M., measuring the decibel tolerances of the individual gears. Not only does this help us produce silent-running gears, but it is also one example of the extensive checking and testing to which we subject our gears, to be *sure* of maintaining our reputation for delivering only *good* gears.

This checking and testing, which is the responsibility of my department, is one of the most important functions in our plant. It's always *possible* for a "rotten apple" to slip into the barrel, but it's *essential* that it be found and removed before shipping. That's why my department can't afford to make any mistakes, or compromise in any way. Top management realizes this; they provide us with the best available equipment, and I report directly to our President (eliminating any possibility of "shop influences" in our testing standards). As a result, our customers have the assurance that when they send us an order they'll receive only the best custom gears obtainable.

THE CINCINNATI GEAR CO.
CINCINNATI 27, OHIO
"Gears—Good Gears Only"

CINTI



NIPPLE THREADING MACHINERY
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.

NUMBERING MACHINES
Acromark Co., 9-11 Morrell St., Elizabeth, N. J.

NUT SETTING EQUIPMENT
See Screw Driving and Nut Setting Equipment.

NUT TAPPERS
See Bolt and Nut Machinery.

NUTS, Cold Forged, Wing and Cap
Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.

NUTS, Thumb or Wing and Cap
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

OIL CUPS
Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago, Illinois

OIL EXTRACTORS AND CLEANERS
De Laval Separator Co., Poughkeepsie, N. Y.

OIL HOLE COVERS
Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago, Illinois

OIL GROOVERS
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

OIL SEALS
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Garlock Packing Co., Palmyra, N. Y.

OILERS AND LUBRICATORS
Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago, Illinois
Madison-Kipp Corp., Madison, Wis.

OILS, Cutting
See Cutting and Grinding Fluids.

OILS, Lubricating
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 5th Ave., New York.
Socony Mobil Co., Inc., 26 Broadway, New York, N. Y.
Standard Oil Co., (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart Oil Co., Ltd., D. A., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

OILS, Quenching and Tempering
Cities Service Oil Co., 70 Pine St., New York N. Y.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 5th Ave., New York.
Standard Oil Co., (Indiana), 910 S. Michigan
Stuart Oil Co., Ltd., D. A., 2739 S. Troy St., Chicago, Ill.

OILS, Soluble
See Compounds, Cutting, Grinding, Metal Drawing, Etc.

OPTICAL FLATS
Crane Packing Co., 1800 Cuyler Ave., Chicago.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

ORDNANCE MACHINES, Special
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Michigan Drill Head Co., Detroit 34, Mich.
Milholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

PACKING, Leather, Metal, Rubber Asbestos, Etc.
Crane Packing Co., 1800 Cuyler Ave., Chicago.
Garlock Packing Co., Palmyra, N. Y.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.

PAINTING EQUIPMENT, Spray
Lowe Bros. Co., Dayton, Ohio.

PARALLELS
Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett, The L. S., Co., Athol, Mass.
Walker, O. S., Co., Inc., Worcester, Mass.

PATTERNS, Wood and Metal
Mummert-Dixon Co., Hanover, Pa.

PILLOW BLOCKS
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.

PIPE, Brass and Copper
American Brass Co., 25 Broadway, New York, N. Y.
American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Bridgeport Brass Co., Bridgeport, Conn.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

PIPE, Steel
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Orban, Kurt, & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
United States Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

PIPE THREADING AND CUTTING MACHINES
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.

PIPE TONGS
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

PLANER ATTACHMENTS
Consolidated Mch. Tool Corp., Rochester, N. Y.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave., and Penn R. R. Evanston, Cincinnati, Ohio.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.

PLANERS, Double Housing and Openside
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio (Plate).
Consolidated Mch. Tool Corp. (Incl. Plate, Rotary and Crank Types), Rochester, N. Y.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A. Co., Woodburn Ave., and Penn R. R. Evanston, Cincinnati, Ohio.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.

PLATE ROLLS
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.

Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ryerson, Joseph T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

PLATES, Surface

Brown & Sharpe Mfg. Co., Providence, R. I.
Challenge Machinery Co., Grand Haven, Mich.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

PNEUMATIC EQUIPMENT

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Ingersoll-Rand Co., Phillipsburg, N. J.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.

POLISHING LATHES AND MACHINES

Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

POLISHING TOOLS, Portable

Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Thor Power Tool Co., Aurora, Illinois

POWER UNITS, Hydraulic

See Hydraulic Power Units or Tool Heads

PRESSES, Arbor

Acromark Co., 9-11 Morrell St., Elizabeth, N. J.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
duMont Corp., Greenfield, Mass.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Threadwell Tap & Die Co., Greenfield, Mass.
Tomkins-Johnson Co., 614 No. Mechanic St., Jackson, Mich.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

PRESSES, Broaching

American Broach & Mch. Co., Ann Arbor, Mich.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Federal Press Co., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Lake Erie Engrg. Co., Kenmore Station, Buffalo, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.

PRESSES, Extrusion

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Federal Press Co., Elkhart, Ind.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Engrg. Co., Kenmore Station, Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

PRESSES, Foot

Acromark Co., 9-11 Morrell St., Elizabeth, N. J.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.

PRESSES, Forging

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Clearing Mch. Corp., Div. U. S. Industries, Inc., 6499 W. 65th St., Chicago, Ill.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E. Cleveland, Ohio.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
Erie Foundry Co., Erie, Pa.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

PRESSES, Hydraulic

American Broach & Mch. Co., Ann Arbor, Mich.
Anderson Bros., Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Milling Machine Co., Process Machinery Div., Cincinnati 9, Ohio
Clearing Mch. Corp., Div. U. S. Industries, Inc., 6499 W. 65th St., Chicago, Ill.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Detroit Broach Co., (special & Semi-special) P. O. Box 156, Rochester, Mich.
Erie Foundry Co., Erie, Pa.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Federal Mch. & Welder Co., Warren, Ohio.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

PRESSES, Screw

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Dake Corp., 604 Seventh St., Grand Haven Mich.
Ferracute Machine Co., Bridegton, N. J.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.

PRESSES, Sheet Metal Working

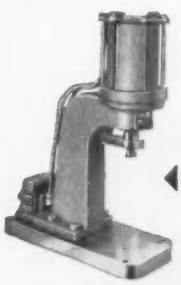
Allen, Alva F., Box 426, Clinton, Mo. (Bench)
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio.
Bath, Cyril Co., Aurora & Solon Road, Solon, Ohio
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Milling Machine Co., Process Machinery Div., Cincinnati 9, Ohio
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Clearing Mch. Corp., Div. U. S. Industries, Inc., 6499 W. 65th St., Chicago, Ill.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 50, Ill.
Erie Foundry Co., Erie, Pa.
Espen-Lucas Machine Works, Front St., and Girard Ave., Philadelphia, Pa.
Farquhar, A. B., Div. Oliver Corp., York, Pa.

(Continued on page 314)

SAVE!

WITH A HANNIFIN AIR PRESS

It's the ideal press for that occasional pressing job. These presses operate off ordinary shop air supply. They're fast and safe. Over 30 models to choose from...many for either bench or floor mounting. Capacities from ½ to 18 tons. Daylight to 46 inches...reach to 12 inches. Prompt delivery.

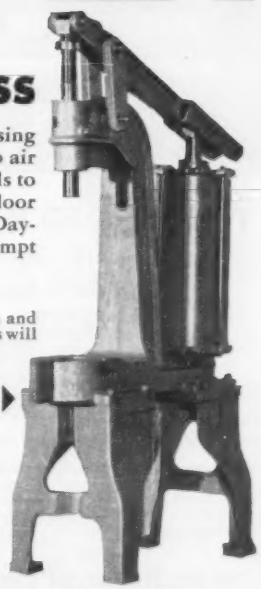


WRITE. Complete information and prices on Hannifin Air Presses will be sent on request.

6 Tons (Model B-2) One of more than 30 models. Press with base, $519.

1-ton Hand-D-Press. For small parts manufacturers. Press only, without valves, $232.

Prices F.O.B. our press plant, St. Marys, Ohio, subject to change without notice.



HANNIFIN

HANNIFIN CORPORATION, 509 S. WOLF ROAD, DES PLAINES, ILLINOIS

When product designs for welded steel

Have twice the rigidity... three times the strength

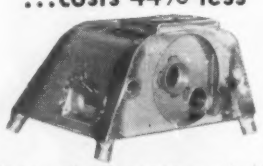
Yet require less material ...cost less to fabricate

WHY

aren't all your products designed for welding?

THE WELDED WAY

20% more rigid ...costs 44% less



Welded from 16 gauge sheet this power headstock weighs 28% less than cast iron design. Photo courtesy Oster Manufacturing Company, Cleveland, Ohio.

Let Lincoln show you how to duplicate these advantages in your products.

Write

THE LINCOLN ELECTRIC COMPANY

Dept. 1213 • Cleveland 17, Ohio

Creating Lower Cost for Industry... With Welded Steel

Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Federal Press Co., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
Johnson Machine & Press Corp., Elkhart, Ind. Pittsburgh, Pa.
L & J Press Corp., Elkhart, Ind.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Minster Machine Co., Minster, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd and S. Kenwood Ave., Chicago, Ill.
Wales-Strippet Corp., North Tonawanda, N. Y.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

PRESSES, Straightening

Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
Erie Foundry Co., Erie, Pa.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
Lake Erie Eng. Corp., 470 Woodward Ave., Buffalo, N. Y.
Niagara Machine & Tool Works (Hydraulic), 683 Northland Ave., Buffalo, N. Y.
Springfield Mch. Tool Co., Springfield, Ohio.
Verson Allsteel Press Co., 93rd St. & Kenwood Ave., Chicago, Ill.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

PROFILING MACHINES

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Gorton, George Machine Co., 1110 W. 13th St., Racine, Wis.
Morey Machinery Co., Inc., 383 Layfette St., New York 3, N. Y.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

PULLEYS

Boston Gear Works, 3200 Main St., North Quincy 71, Mass.

PULLEYS, Friction Clutch

Brown & Sharpe Mfg. Co., Providence, R. I.

PUMPS, Coolant, Lubricant and Oil

Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Gray-Mills Co., 1948-52 Ridge Ave., Evanston, Ill.
Ingersoll-Rand Co., Phillipsburg, N. J.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Ruthman Machinery Co., 1809 Reading Rd., Cincinnati 12, Ohio.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Tomkins-Johnson Co., Jackson, Mich.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.

PUMPS, Hydraulic

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engrg. Co., Chambersburg, Pa.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
Ingersoll-Rand Co., Phillipsburg, N. J.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Vickers Incroporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.

PUMPS, Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.

PUMPS, Rotary

Brown & Sharpe Mfg. Co., Providence, R. I.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.

PUNCHES AND DIES

See Dies, Sheet Metal, Etc.

PUNCHES, Centering

Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.

PUNCHING MACHINERY

Allen, Alva F., Box 426, Clinton Mo.
Bath, Cyril Co., Aurora & Solon Road, Solon, Ohio
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Ryerson, Joseph T., & Son Inc., 2558 W. 16th St., Chicago 18, Ill.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Wales-Strippet Corp., North Tonawanda, N. Y.
Wiedemann Machine Co., 4272 Wissahickon Ave., Philadelphia, Pa.

RACKS, Gear Cut

Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.

REAMER HOLDERS

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Warner & Swasey Co., 8701 Carnegie Ave., Cleveland 3, Ohio.

REAMERS

Ace Drill Corp., Adrian, Michigan.
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

REAMERS, Adjustable

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.

For more information fill in page number on Inquiry Card, on page 241

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

REAMERS, Taper Pin

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Greenfield Tap & Die Corp., Gresenfield, Mass.
Kaufman Manufacturing Co., Manitowoc, Wis.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

REAMING MACHINES

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Greaves Machine Tool Co., 2009 Eastern Avenue, Cincinnati, Ohio.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Kaufman Manufacturing Co., Manitowoc, Wis.
Michigan Drill Head Co., Detroit 34, Mich.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

RECORDING INSTRUMENTS

National Acme Co. (for counting), 170 E. 131st St., Cleveland, Ohio.

REELS, Stock, Standard and Automatic

U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

REFRACTORS, Heat-Treating Furnace

Norton Co., 1 New Bond St., Worcester 6, Mass.

REGULATORS, Temperature

General Electric Co., Schenectady, N. Y.

REMOVERS, Japan, Enamel, Etc.

Oakite Products, Inc., 19 Rector St., New York, N. Y.

RETAINING RINGS FOR BEARINGS, Etc.

Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Waldes-Kohinoor, Inc., 4716 Austel Place, Long Island City 1, N. Y.

RHEOSTATS

Allen-Bradley Co., 1326 S. 2nd St., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.

RIVET SETS

Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.

RIVETERS, Hydraulic

Bethlehem Steel Co., Bethlehem, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.

RIVETERS, Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Thor Power Tool Co., Aurora, Illinois
Wood & Co., R. D. Public Ledger Bldg., Philadelphia, Pa.

RIVETING MACHINES

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.

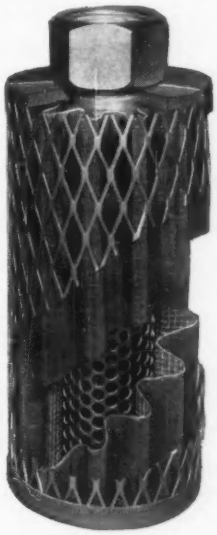
(Continued on page 316)

More and More Manufacturers are Installing

MARVEL SYNCLINAL FILTERS

AS STANDARD EQUIPMENT

Manufacturers of hydraulically actuated equipment and others with low pressure liquid circulating systems demand their equipment to perform consistently with all the productive efficiency they build into the machine that bears their name. Since these systems must be kept free of damaging particles, the selection of a filter is an important factor. Here are some of the outstanding reasons for the increasing preference for Marvel Synclinal Filters to do this all-important job!



SUMP TYPE (cutaway)

BECAUSE . . . Marvels are designed to give maximum ACTIVE filtering area rather than total filtering area. Only ACTIVE FILTERING AREA COUNTS!

BECAUSE . . . Marvels greater storage space for filtered out particles allows longer periods of "production" time at absolute minimum in maintenance cost and "down-time."

BECAUSE . . . Marvels can be disassembled, cleaned and reassembled by any workman in a matter of minutes. Line type operates in any position and may be serviced without disturbing pipe connection.

BECAUSE . . . Marvels are protected and of sound construction to give long life and efficient filtration. THEY MEET J. I. C. STANDARDS.

BECAUSE . . . Marvels (Both Sump and Line Type) are available in individual capacities from 5 to 100 G.P.M. and choice of mesh sizes ranging from coarse 30 to very fine 200, they get a filter to fit their specific requirements.

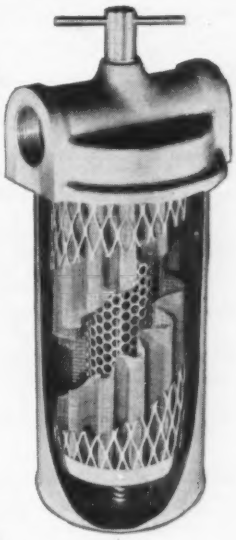
BECAUSE . . . Marvel not only delivers a top grade filter in both quality and performance, but delivers IMMEDIATELY—shipments are made the same day orders are received, if desired.

FACTS—NOT CLAIMS

Engineers decide on the basis of the record, on the basis of measurable facts rather than claims of the "campaign promise" variety. Here is a fact with meaning—

OVER 650 O. E. M.'s

Install MARVEL Synclinal FILTERS as Standard Equipment!



LINE TYPE (cutaway)

For Dependable Protection on All Hydraulic and Low Pressure Systems Investigate

MARVEL SYNCLINAL FILTERS

FILTERS FOR FIRE-RESISTANT HYDRAULIC FLUIDS

Marvel's most recent development is a filter for the efficient filtration of all types of fire-resistant hydraulic fluids.

Catalogs containing complete data available on request

WATER FILTERS

Both sump and line type filters have been adapted for use in all water filtering applications. No changes have been made in the basic, balanced synclinal design.

MARVEL ENGINEERING COMPANY

7227 N. Hamlin Ave., Chicago 45, Ill. PHONE: JUniper 8-6023

Without obligation, please send me complete data on Marvel Synclinal Filters, as indicated

☐ Catalog #107—For Hydraulic Oils, Coolants and Lubricants

☐ Catalog #301—For WATER

Data on Filters for Fire-resistant fluids—

☐ AQUEOUS ☐ SYNTHETIC

Name .....

Company .....

Address .....

City .....

State MY-3

Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Tomkins-Johnson Co., Jackson, Mich.
Townsend, H. P., Mfg. Co., Elmwood, Conn.

RIVET MAKING MACHINES
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.

RUBBER PRODUCTS
Garlock Packing Co., Palmyra, N. Y.

RULES, Steel
Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S. Co., Athol, Mass.

RUST PREVENTIVES
Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Oakite Products, Inc., 19 Rector St., New York, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

SAND BLAST EQUIPMENT
See Blast Cleaning Equipment

SANDERS
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Ingersoll-Rand Co., Phillipsburg, N. J.
Mattison Machine Works, Rockford, Ill.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Thor Power Tool Co., Aurora, Illinois.

SAW BLADES, Hack
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S. Co., Athol, Mass.

SAW SHARPENING MACHINES
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchry Co., Penton Bldg., Cleveland, Ohio.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

SAWING MACHINES, Circular
Consolidated Mch Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchry Co., Penton Bldg., Cleveland, Ohio.
Townsend, H. P., Mfg. Co., Elmwood, Conn.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

SAWING MACHINES, Friction
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

SAWING MACHINES, Metal Cutting Band
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Walker-Turner Div., Kearney & Trecker Corp., South Ave., Plainfield, N. J.

SAWING MACHINES, Power Hack
American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

SAWS, Circular Metal Cutting
Brown & Sharpe Mfg. Co., Providence, R. I.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Consolidated Mch. Tool Corp., Rochester, N. Y.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchry Co., Penton Bldg., Cleveland, Ohio.
National Twist Drill & Tool Co., & Winter Bros., & Co., Rochester, Mich.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

SAWS, Metal Cutting Band
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Johnson Mfg. Co., Albion, Mich.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.

SAWS, Portable Electric
Thor Power Tool Co., Aurora, Illinois

SAWS, Screw Slotting
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.

SCALES
Hydroway Scales Inc., 20618 W. Eight Mile Rd., Detroit, Mich.

SCRAPERS, Hand and Power
Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.

SCREW DRIVERS, Power
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Thor Power Tool Co., Aurora, Illinois

SCREW DRIVING AND NUT SETTING EQUIPMENT
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Thor Power Tool Co., Aurora, Illinois

SCREW MACHINE TOOLS AND EQUIPMENT
Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Colonial Broach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
Pratt & Whitney Co., Inc., West Hartford, Conn.
R and L Tools, 1825 Bristol St., Philadelphia 40, Pa.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester, Mass.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

SCREW MACHINE WORK
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Eastern Mch. Screw Corp., New Haven, Conn.
Mueller Brass Co., Port Huron 35, Mich.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Ottemiller, M. H., Co., York, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

SCREW MACHINES, Automatic Single and Multiple Spindle
American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, George, Mch Co., 1110 W. 13th St., Racine, Wis.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Townsend, H. P., Mfg. Co., Elmwood, Conn.

SCREW MACHINES, Hand
See also Lathes, Turret
American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

SCREW PLATES
Greenfield Tap & Die Corp., Greenfield, Mass.
Threadwell Tap & Die Co., Greenfield, Mass.

SCREWS, Cap, Set, Safety Set and Machine, Etc.
Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Ottemiller, W. H. Co., York, Pa.
Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.
Standard Pressed Steel Co., Jenkintown, Pa.

SCREWS, Self-Tapping, Drive
Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.

SCREWS, Thumb
Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

SEALS AND RETAINERS, Oil or Grease
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago, Illinois
Garlock Packing Co., Palmyra, N. Y.

SECOND-HAND MACHINERY, Etc.
Eastern Machinery Co., 1006 Tennessee Ave., Cincinnati 22, Ohio.
Miles Machinery Co., Box 770, Saginaw, Mich.

SEPARATORS, Centrifugal
De Laval Separator Co., Poughkeepsie, N. Y.

SEPARATORS, Oil or Coolant
Barnes Drill Co., (Magnetic), 814 Chestnut, Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.

SHAFTING, Steel
Bethlehem Steel Co., Bethlehem, Pa.
Cumberland Steel Co., Cumberland, Md.
De Laval Separator Co., Poughkeepsie, N. Y.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

SHAFTS
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.

SHAFTS, Hollow-Bored
Bethlehem Steel Co., Bethlehem, Pa.

SHAFTS, Turned and Ground
Bethlehem Steel Co., Bethlehem, Pa.
Cumberland Steel Co., Cumberland, Md.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

(Continued on page 318)

New Machine Performs 3 Operations Automatically With One Loading

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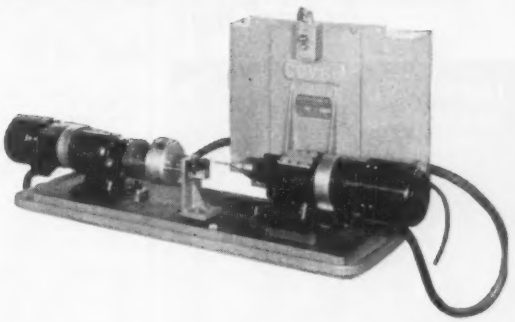

If you are faced with the problem of speeding up the drilling of small parts, it will be to your advantage to acquaint yourself with this new bench-type drilling machine which incorporates 2 Govro-Nelson Automatic Drilling Units, one with a 2-spindle head, originally designed for drilling and counterboring an aluminum collar.

The operator loads and clamps the part in a simple fixture, then depresses the start-cycle switch, whereupon the left-hand drilling unit automatically feeds forward and drills two holes. The withdrawal of the spindles causes the right-hand unit to feed in automatically to counterbore one of the two holes previously drilled.

With this simple set-up, the three operations are performed automatically at an output rate in excess of 300 pieces per hour.

By making slight changes in mounting and fixtures, the machine is readily adaptable to drilling a variety of parts. Send for complete information.

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SET SCREWS • MILLED STUDS
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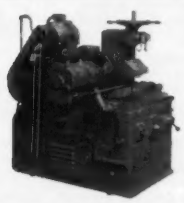

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all sizes up to 14" capacity,
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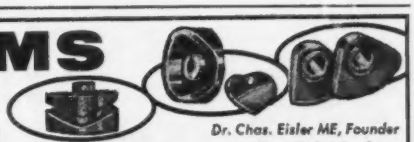
CAMS

ALL TYPES MADE TO YOUR SPECS!



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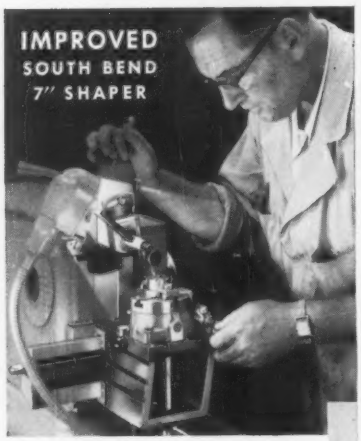
for Small Work



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These popular lathes offer maximum value for your equipment dollars. Their quality and construction will give long years of dependable, efficient service on close-tolerance machining of small parts. Factory prices from $234, less electrical equipment. Write for Catalog. 85 other models and sizes to choose from to meet your needs.

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SHAPERS

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
American Tool Works Co., Pearl and Eggleston Ave., Cincinnati, Ohio.
Atlas Press Co., Kalamazoo, Mich.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Barber-Colman Co. (Hendey Mch. Div.) Rockford, Ill.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

SHAPERS, Vertical

Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

SHAPERS, Structural

Bethlehem Steel Co., Bethlehem, Pa.
U. S. Steel Corp. (Carnegie-Illinois Steel Corp., Div. Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

SHEARING MACHINERY

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Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E. Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Yoder Co., 550 Walworth Ave., Cleveland, Ohio.

SHEARS, Alligator

Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.

SHEARS, Rotary

Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E. Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co. (Knives), 470 Main St., Fitchburg, Mass.

SHEARS, Squaring

Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E. Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Hamilton Div. of the Lodge & Shipley Co., Hamilton 1, Div. of the Lodge & Shipley Co., Hamilton 1, Ohio.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Simonds Saw & Steel Co., (Blades), 470 Main St., Fitchburg, Mass.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

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American Brass Co., 25 Broadway, New York, N. Y.
Bethlehem Steel Co., Bethlehem, Pa.
Bridgeport Brass Co., Bridgeport, Conn.
New Jersey Zinc Co., 160 Front St., New York, N. Y.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., (Carnegie-Illinois Steel Corp., Div. Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

SHEETS, Iron and Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., (Carnegie-Illinois Steel Corp., Div. Columbia Steel Co., Div. Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

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Laminated Shim Co., Inc., Glenbrook, Conn.

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Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Shenango-Penn Mold Co., Dover, Ohio.

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Consolidated Mch. Tool Corp., Rochester, N. Y.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Townsend, H. P., Mfg. Co., Elmwood, Conn.

SOCKETS

Armstrong Bros., Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Wks., 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
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Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Baker Bros., Inc., Sta. F., P.O. Box 101, Toledo 10, Ohio.
Bath, Cyril Co., Aurora & Solon Road, Solon, Ohio
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bethlehem Steel Co., Bethlehem, Pa.
Bilgram Gear & Mch Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Colonial Broach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Coulter, James, Machine Co., Bridgeport 5, Conn.
Cross Co., Detroit, Mich.
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Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
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Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
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Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
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Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greenlee Bros. & Co., 12th and Columbia Aves, Rockford, Ill.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
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(Continued on page 320)

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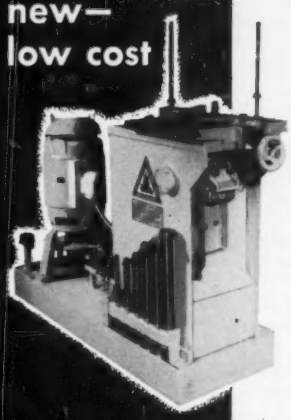

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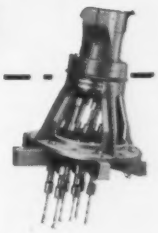

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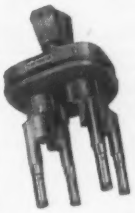

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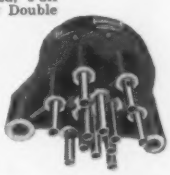

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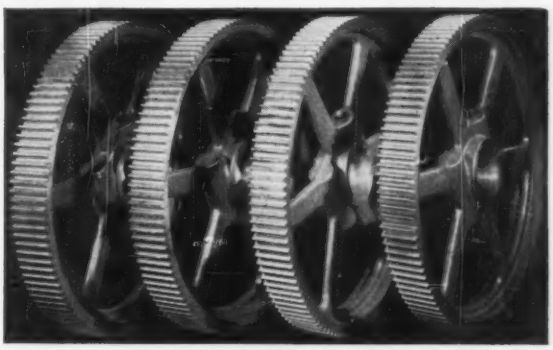

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Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
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National Acme Co., 170 E. 131st St., Cleveland, Ohio.
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National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
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New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
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Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.
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Zagar Tool Co., 24000 Lakeland Blvd., Cleveland 23, Ohio.

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Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio.
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Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

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Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp., (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp., Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.
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Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
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U. S. Steel Corp., (American Steel & Wire Co.), Div., 436 7th Ave., Pittsburgh, Pa.
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Simonds Saw & Steel Co., 470 Main St., Fitchburgh, Mass.
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Timken Roller Bearing Co., Canton, Ohio.
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Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
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Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
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STEEL BARS

See Bars, Steel

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Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
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DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
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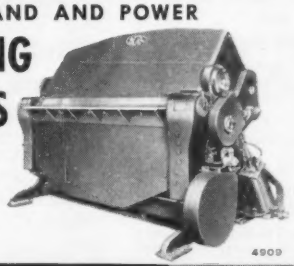

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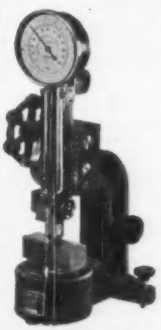

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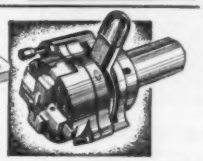

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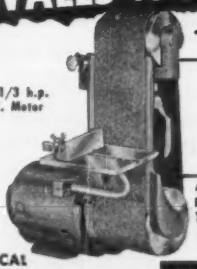

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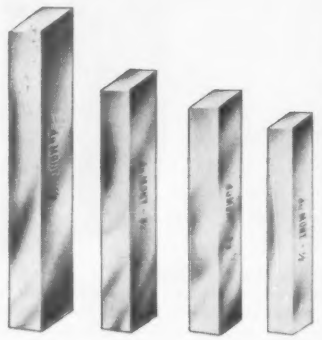

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Landis Mch. Co. (Solid Adjustable), Waynesboro, Pa.
Pratt & Whitney Co., Inc., West Hartford, Conn.
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Colonial Broach Co., Detroit 13, Mich.
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du Mont Corp., Greenfield, Mass.
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Kennametal, Inc., Latrobe, Pa.
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(Continued on page 324)

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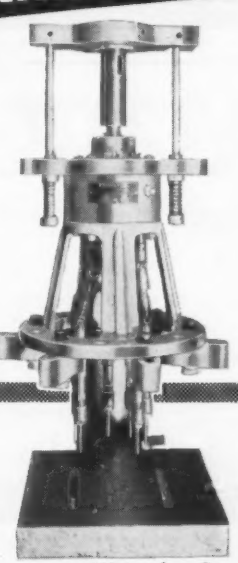

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Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
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But the tragic fact, our doctors tell us, is that every third cancer death is a needless death... *twice* as many could be saved.

For the facts of *life* about cancer, call the American Cancer Society office nearest you or write to "Cancer" in care of your local Post Office.

American Cancer Society®

eastern Rebuilt Machine Tools
THE SIGN OF QUALITY
THE MARK OF DEPENDABILITY

The listing below is only a VERY SMALL AMOUNT of the total number of machine tools that we have in stock for immediate shipment. Our prices are realistic with today's market and our quality of rebuilding is the same high standard—THE LEADER IN THE FIELD OF REBUILT MACHINE TOOLS

RAILROAD MACHINERY
No. 2 Niles-Bement-Pond Axle Lathe, m.d.
No. 3 Niles-Bement-Pond Axle Lathe, m.d.
52" Betts Car Wheel Borer
90" Niles Balanced Quartering & Crank Pin Turning Machine, latest
90" Putnam Driving Wheel Lathe, m.d.
90" Niles Journal Lathe, including 2 inside Journal Turrets and 3½" spindle double quartering attachment, m.d.
90" Niles Driving Wheel Lathe, m.d., latest
No. 3 Betts Bridgeford Axle Lathe, m.d.
Betts Bridgeford Combination Journal Truing & Axle Lathe, 3 carriages, new

SHAPERS
No. 14 Cochran Bly Vertical Shaper, m.d.
16" Gould & Eberhardt Shaper, m.d.
24" Hendey Back Geared Crank Shaper, m.d.
24" Potter & Johnston, cone
32" Morton Draw-Cut, m.d., late
32" Ohio Shaper, m.d.
32" Cincinnati, m.d., late
32" Columbia H.D. Plain Back Geared Crank Shaper, m.d.
36" Morton Draw-Cut, m.d., late
36" Rockford Universal Openside Shaper Planer, m.d.
38" Morton Draw-Cut Shaper

TAPPERS
No. 1 Bakewell, m.d., late
No. 1 Haskins, pneumatic control, type 1 CAM
No. 2 Haskins, pneumatic control, type 2 CAM
No. 3 Haskins, pneumatic control, type 3 CAM
Acme Semi-Automatic 6 spindle, 1⅛", automatic for m.d.
No. 3C Haskins, pneumatic control, type 3 CAM
2 spindle Haskins, pneumatic control, m.d.
No. 22 Murchey, 6 to 28 pitch
3 way Natco Tapper & Drill

SHEET METAL MACHINERY
No. 2 Libert Nibbler, 28" throat
No. 3—⅝" capacity Gray Sheet Metal Cutter, m.d.
12'x⅜" cap. Dreis & Krump Leaf Brake, m.d.
Size 848 Model O Parker Tube Bender, hand operated
No. 6 Niles Pyramid Type Plate Bending Roll, 12'x⅝", m.d.
No. 11-SBC Buffalo Armor Plate Bar Cutter, m.d.
No. 47 Buffalo Double End Shear and Bar Cutter, m.d.
Model 1236 Libert High Speed Nibbler Type Shear, m.d.
Brand New Webb Model BR-6 Pyramid Type Plate Bending Roll
Gray Turret Head Metal Cutter, m.d.
No. 3 Ryerson Rotary Bevel Shear
#6½ Hilles & Jones Gate Shear

TURRET LATHES AND SCREW MACHINES
No. 601 W. D. Oster Geared Head Rapiduction, m.d., chucking
No. 1 Warner & Swasey "Electric", m.d., bar
No. 1A Warner & Swasey, m.d., 1940
No. 1L Gisholt Universal, m.d., 1943
No. 1, 2 Cincinnati Acme Full Universal, m.d.
No. 1-H-5 Libby, m.d.
No. 2A Warner & Swasey, m.d., preselector head, late
No. 2F Foster Fastermatic, m.d., Timken
No. 2L Gisholt Universal, m.d., latest type, 1945
No. 3 Cincinnati Acme Full Universal, m.d., chucking
No. 3 Foster Geared Head, m.d.
No. 3 Bardons & Oliver Universal Ram Type, m.d.
No. 3 Jones & Lamson, m.d., 1943
No. 3A Warner & Swasey, m.d., 1942
No. 3F Foster Fastermatic, m.d., Timken
No. 4 Warner & Swasey, cone, bar and chucking types
No. 4A Warner & Swasey, Universal, m.d., chucking, 1939
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No. 4L Gisholt Universal, m.d., 1943
No. 4FU Foster Fastermatic, m.d., latest, 1945
No. 5 Gisholt Universal m.d., late type, 1942
No. 7A Jones & Lamson Universal
⅝" Pratt & Whitney Hand Screw Machine, cone, bar
2½x24", 3½x32", 4x34" Jones & Lamson Geared Head, m.d., bar and chucking
18" Libby Type A, m.d., chucking
20" Acme, s.p.d., bar
20" Dreses, arranged for factory m.d.
26" Libby Type C, m.d., chucking

MISCELLANEOUS
Model 20074 Logansport Arbor Press
2" Acme All Steel Heading, Upsetting & Forging Machine, m.d.
Sciaky Type PMCO-28-31 Storage of Energy Spot Welder, 50 KW, 34" throat
Federal Machine Co. Rocker Arm Spot Welder, 1440 KVA-MFD, 220 volts
No. 70 Cross Deburring Machine, m.d., 1940
Pratt & Whitney Standard Measuring Machine, 36" capacity
Type 114CB Moline Tool Boring Machine, two spindle type, m.d.
No. 118 Cochran Bly Saw Sharpening Machine, belted m.d.
Brinnell Hardness Tester
Wagner Saw Sharpener, m.d.
No. 11 Cochran Bly Saw Sharpener, belt drive
Logan Hydraulic Vertical Shaper, m.d., 6" stroke
Detroit Model A Power Screw Driving Machine, m.d.
Gorton Model AE Engraver, hand feed type
#1 Fischer Oil Groover, m.d., 1942
Cogan Hardness Tester, model 1618, 1942
Gisholt Precision Balancing Machine, m.d.
Lerol Electric Power Plant
No. 2 Cochran Bly Filing Machine, pedestal type
Hanchett Grinding Head, Vertical type for mounting on planer rail
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1 ton Shaw Electric Cable Hoist
Brown & Sharpe Universal Attachment, for use on 2A Brown & Sharpe Miller
63" Walker Rotary Magnetic Chuck, 230 volt D.C., new
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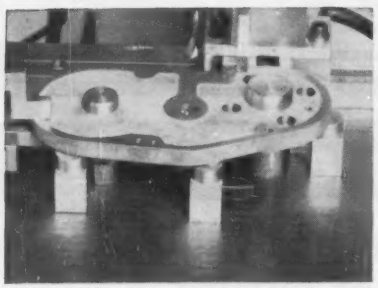
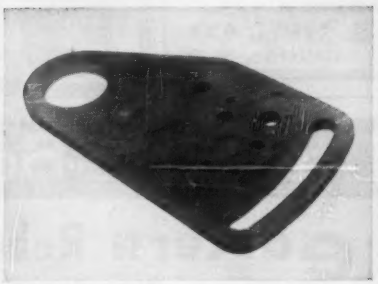
production and trade, best references, seeks representation of or technical cooperation (construction under license) with American Company engaged in machine construction, automobile accessories and metal processing. Please write Box No. M25 647 CARL GABLER WERBEGESELLSCHAFT MBH., Frankfurt/Main, Kaiserstrasse 15/Germany.

MACHINE TOOLS
24" x 12' Boye & Emmes Geared Head Engine Lathe. 5'6" Centers, Taper attachment, Timken Precision Taper Roller Bearing Spindle. Rebuilt and Guaranteed. Late Type.
FALK MACHINERY CO.
19 Ward Street — BA 5887 — Rochester, N. Y.

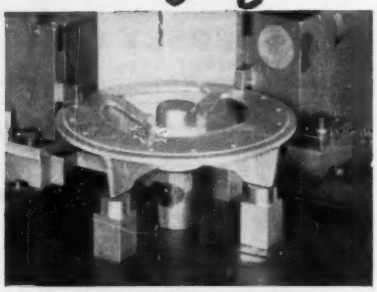
DRILL PARTS LIKE THESE . . . *Without Jigs!*



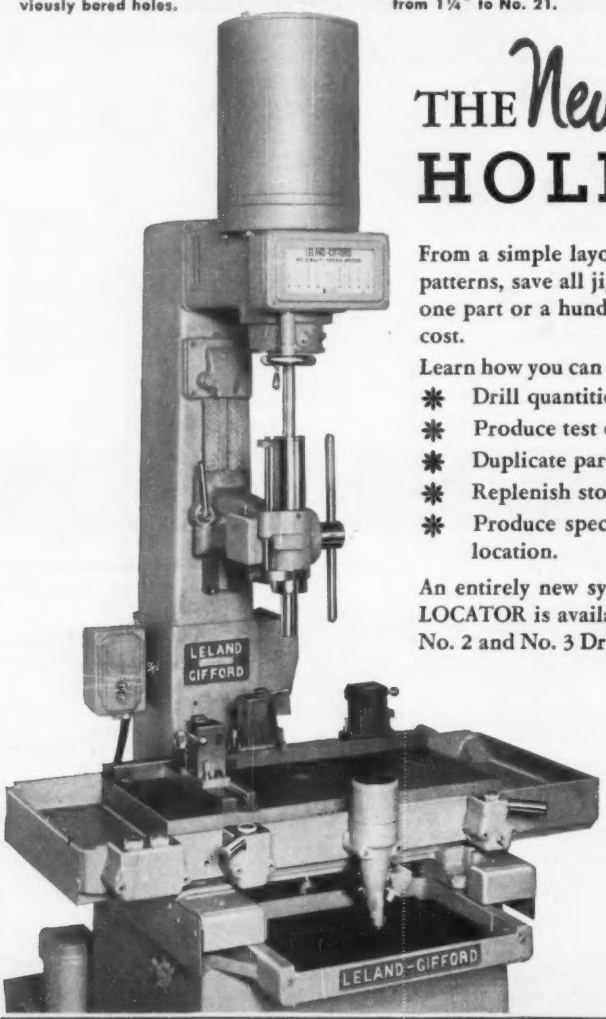
Thirteen holes (4 tapped, 1 reamed, 4 counterbored) are drilled in relation to two previously bored holes.



Nine holes plus five extra operations take only 24 minutes per part. Hole sizes range from 1¼″ to No. 21.



Twelve holes are drilled and tapped in this aluminum motor fan in precise relation to the hub and webs.



THE *New* LELAND-GIFFORD HOLE LOCATOR

From a simple layout chart, you can locate and drill complex hole patterns, save all jig costs, eliminate piece by piece layout, produce one part or a hundred in a fraction of the time, at a fraction of the cost.

Learn how you can use the new Leland-Gifford HOLE LOCATOR to:

- Drill quantities of parts not requiring jig borer accuracy.
- Produce test or experimental pieces.
- Duplicate parts for repair or maintenance.
- Replenish stocks of replacement parts.
- Produce special parts requiring modification in hole size or location.

An entirely new system for locating and drilling holes, the HOLE LOCATOR is available in the capacities of standard Leland-Gifford No. 2 and No. 3 Drilling Machines. Write for complete information.

HOW IT WORKS

Hole locations are precisely established from intersecting lines scribed on a metal chart from blueprint dimensions. An optical viewer with double cross hairs and 20X magnification aligns the table with the layout chart which is registered in relation to the machine spindle. Dual locks release to permit lateral, forward and back, or compound motion of the table. The work is held on the table by quick-acting clamps. Duplicate parts can be produced from the same layout or the chart can be filed for future use.

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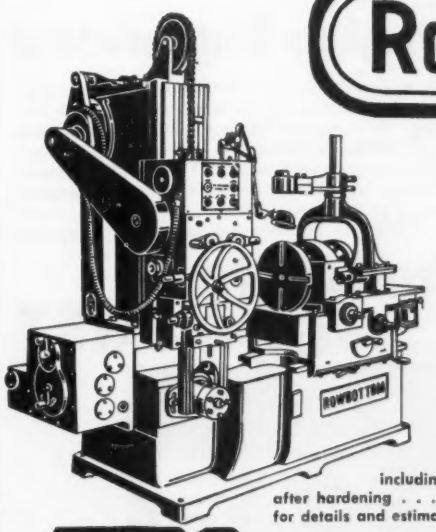

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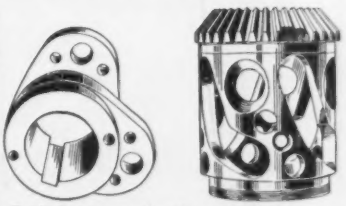
. . . for
fast, low cost production of all types

Take advantage of Rowbottom's long, specialized experience in building cam millers and cam grinders . . . machines designed for modern, fast production of box, barrel and face cams in sizes up to 32" O.D. Should it be more practical, call on Rowbottom to act as your cam-making department, producing your requirements exactly to your specifications, promptly, economically. Rowbottom offers a complete service including design of cams and cams ground after hardening . . . in all sizes, types and quantities. Ask for details and estimates.



Typical cams produced on Rowbottom machines.

Rowbottom CAMS

THE ROWBOTTOM MACHINE CO.

WATERBURY CONN.

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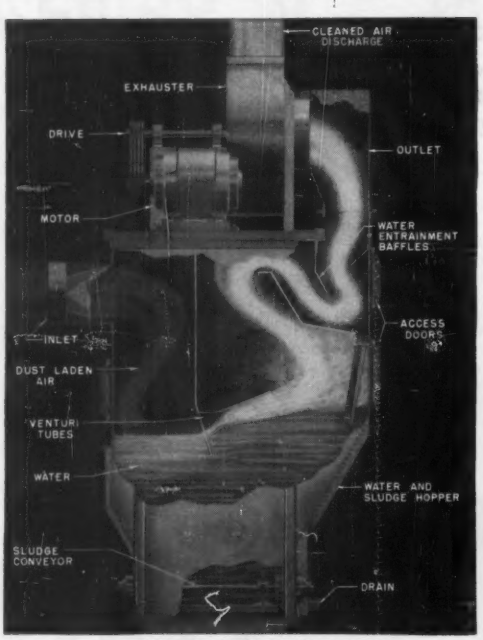
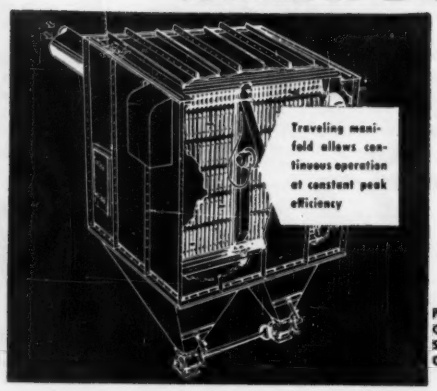
NOW—Great news about two new Pangborn Dust Collectors!



PANGBORN VENTRIJET WET COLLECTOR

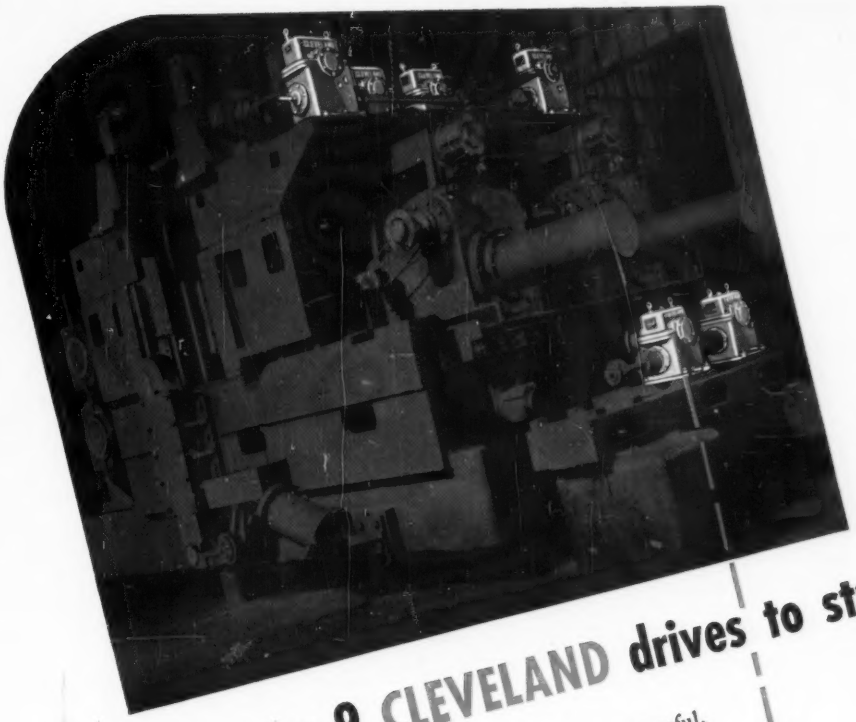
These two new developments in industrial dust control by Pangborn are designed to handle any dust problem! The new Pangborn Self-Cleaning Collector utilizes a traveling reverse air manifold for continuous operation at constant peak efficiency. Use the new Pangborn Ventrijet for effective control of dusts a dry collector cannot handle! For complete information, write to: PANGBORN CORPORATION, 1200 Pangborn Boulevard., Hagerstown, Maryland.

Pangborn CONTROLS DUST



PANGBORN CONTINUOUS SELF-CLEANING COLLECTOR

For more information fill in page number on Inquiry Card, on page 241



Six of nine Cleveland Worm Gear Drives in use on the Anvil Lift Drive of this Mesta Gag Press are in view.

Gag press uses 9 CLEVELAND drives to straighten steel

BIG equipment . . . doing a big job. Smooth, powerful, dependable speed transmission is vital here—and this gag press, designed and built by Mesta Machine Company, has it . . . thanks to 9 Cleveland Worm Gear Drives.

Cleveland Worm Gearing—the dependable drive—affords exceptional advantages for practically any power job. Steel worm on bronze gear provides the best possible medium to transmit power with minimum friction and wear—reduces motor speed evenly, efficiently and quietly. Right angle drive makes a worm gear reducer compact and rugged, with few moving parts. And when it's a Cleveland, you get extra benefits from 44 years of experience concentrated on making worm gear drives.

Get the full Cleveland story on power transmission. Write for Catalog 400; ask for technical advice on any problem you may have. Then, you'll specify Cleveland Worm Gear Drives. The Cleveland Worm and Gear Company, 3276 East 80th Street, Cleveland 4, Ohio.

Affiliate: The Farval Corporation, Centralized Systems of Lubrication. In Canada: Peacock Brothers Limited.

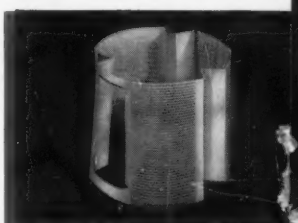
CLEVELAND
Worm Gear
Speed Reducers

the *CLEARING ROBOT* that's setting records at HOTPOINT

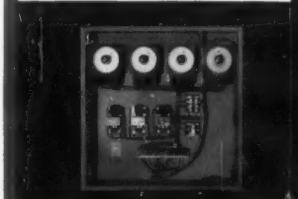
Here's a Clearing high speed press that's making steel confetti fly at Hotpoint's Home Laundry plant in Chicago. Each piecepart has 5,000 perforations which are grouped in three different locations. The press operates at a speed range of 125 to 250 strokes per minute and "thinks" for itself in the matter of locating the hole groupings and the number of holes which is correct for each grouping.

The result is a finished part from which the cylinder of a dryer basket is made. It's a result that gives Hotpoint accurate parts, produced economically with a minimum of material handling.

If there is a place for one of "Speedy's" energetic and thoughtful brothers in your manufacturing plans, call on a Clearing sales engineer to talk the problem over.



Hotpoint dryer basket after it has been perforated and rolled into its cylindrical shape.



Part of the electronic brain that tells "Speedy" when to start and stop and where to locate the perforations.

CLEARING PRESSES THE WAY TO EFFICIENT MASS PRODUCTION

CLEARING MACHINE CORPORATION • *Division of U.S. INDUSTRIES, INC.*

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